VOL. XXII. No. 8. AUGUST 1937

MECCANO MAGAZINE

A GIANT 800-TON PRESS

6D.

DRIVER CLARKE SAYS "IT'S FINE!"

The new HORNBY SCALE MODEL OF L·M·S RECORD-BREAKER "Princess Elizabeth"



Four hundred miles non-stop at an average of 70 m.p.h.; maximum speeds of 95 m.p.h.; Beattock bank and Shap incline surmounted at 66 m.p.h. with a 260-ton load! These remarkable feats were performed by L.M.S. 4-6-2 *"Princess Elizabeth,"* in charge of Driver T. J. Clarke, on a special run in November 1936.

Think of the thrill of owning a model of such an engine; not merely a perfect reproduction in miniature, but one having the same qualities of power, speed and efficiency! This is now made possible by the latest product of Meccano Ltd.—the magnificent Hornby scale model locomotive *"Princess Elizabeth."* Look at the photograph above! What a splendid appearance the model has with its massive six-coupled driving wheels, fascinating valve gear, and Royal nameplate! It is driven by a 20-volt electric motor, fitted with the world-famous Hornby Remote Control.

Price, complete with tender, in special presentation box, £5 5s 0d.

The model may be purchased also through the new Hornby Deferred Payments Scheme. Ask your dealer for details (Not available outside Great Britain and Northern Ireland.)

HORNBY TRAINS

MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

AERO EDITION

A CARAVAN FOR THE HOLIDAYS

Hamley's News

HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

200-202, REGENT ST., LONDON, W.I. OUR ONLY ADDRESS

Telephone: REGENT 3161

No. 23 August, 1937

HAVE YOU A WOOZLE ?

Let's go caravanning



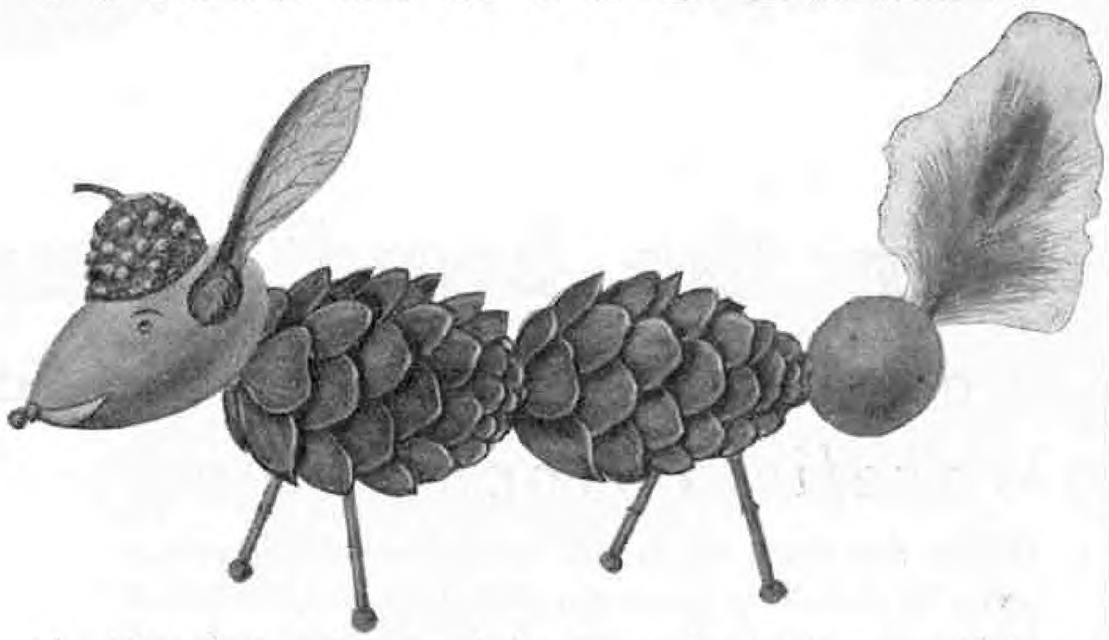
Here's another of those grand MINIC toys. This time it is a perfect model of a Caravan Trailer drawn by an open Tourer. The Trailer is made true to scale and is beautifully finished. Fully fitted even down to electric light. The Tourer is well finished and has a strong clockwork motor with long running powers. Also if you are the proud possessor of another MINIC car, the Trailer will fit that too!

CAR AND TRAILER

PRICE ONLY **4/6**

Complete. Post 6d.

What is a WOOZLE?



The Woozle is only one of the queer, fascinating animals that can be made with the aid of the 'NATURECRAFT' outfit. With the Acorns, Pine Cones, Sycamore, etc., not only real animals such as Owls and Penguins can be made but you can spend hours of enjoyment inventing your own animals. Woozles, Mugwumps, Mulligatawnies and other queer animals are to be made. Buy a set and see what *you* can do.

PRICE **5/-**

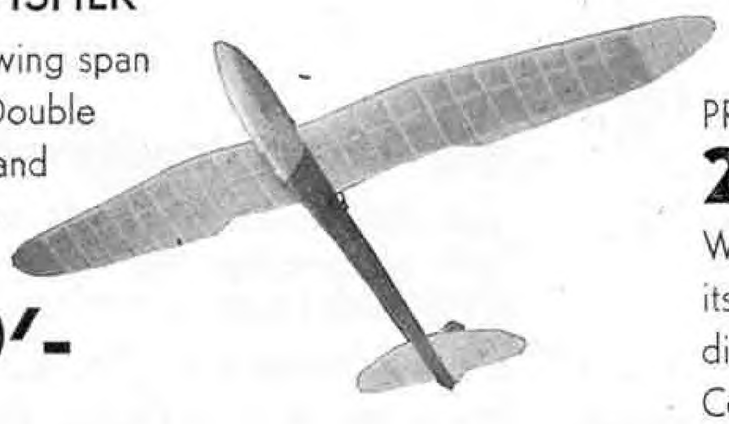
Post 4d.

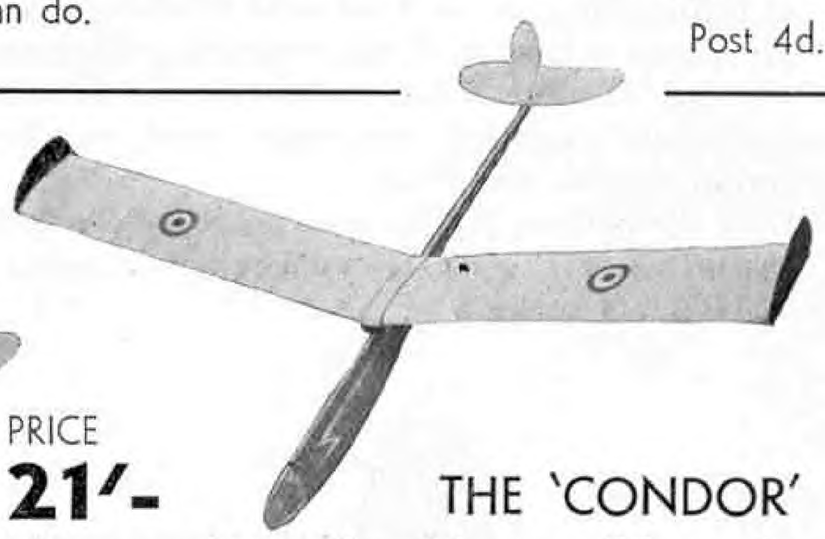
FOUR MODEL GLIDERS

THE 'KINGFISHER'

A really fine competition model with a wing span of four foot. Amazing gliding powers. Double surface gull wing, wire tail unit blue and silver fuselage and white wings. Complete with launching gear. (Foreign.)

PRICE **30/-**



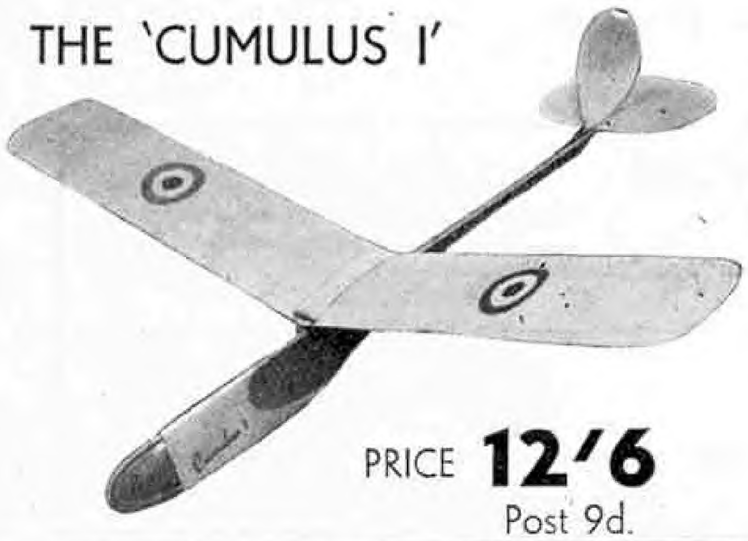


PRICE **21/-**

THE 'CONDOR'

Wing span 44 ins. This glider is well known for its long duration powers of soaring. Will soar a distance of two miles or more. Gliding angle 1-15. Coloured in red and white. Double surface wing and launching gear. (Foreign.)

THE 'CUMULUS I'



PRICE **12/6**

Post 9d.

Wing span 31 ins. Strongly finished. Double surface wing, coloured in red, yellow and white. Complete with launching gear. (Foreign.)

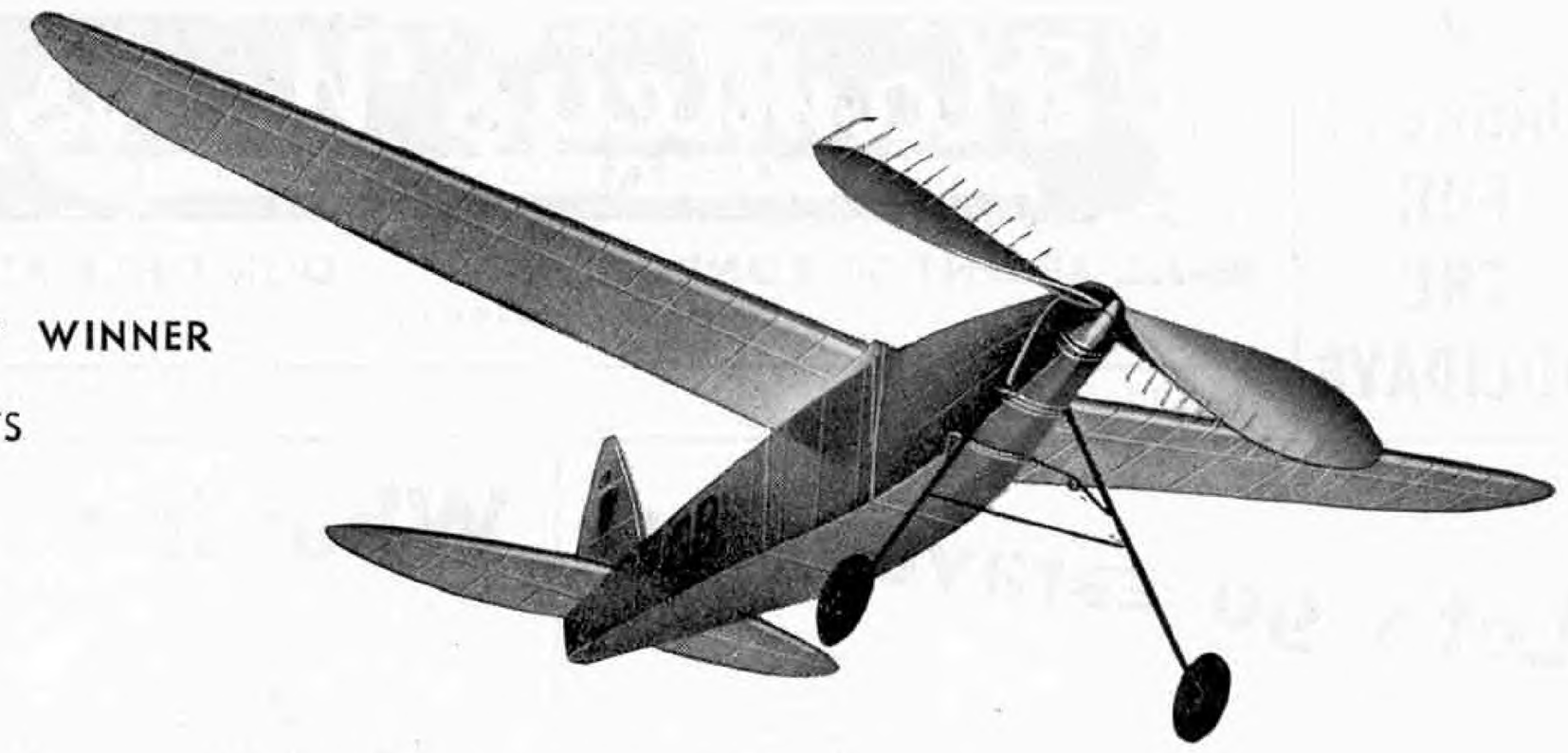
THE 'WREN'

Wing span 38 ins. Double surface gull wing, wire tail unit coloured red and silver. Built to last. Complete with launching gear. (Foreign.)



PRICE **17/6**

Post 9d.



WAKEFIELD TROPHY WINNER

KIT OF PARTS

21/-

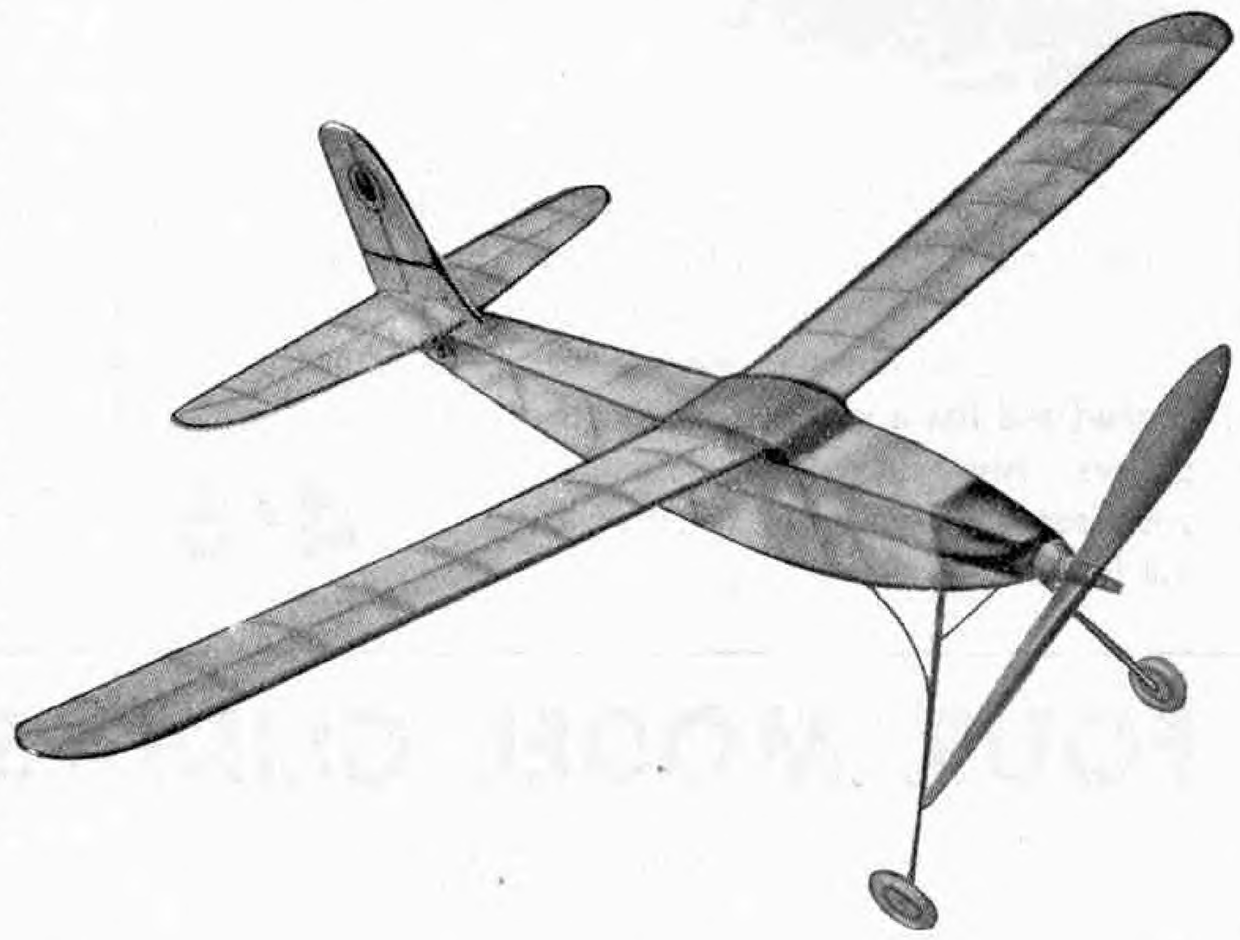
Join the band of experts

You can if you build and fly a replica of the Wakefield Trophy winner

When the team of model aeroplane constructors went to America recently, this model, constructed by its designer-pilot, Mr. A. A. Judge, won for England the Wakefield Cup. During one of its flights it remained in the air over eight minutes.

International Model Aircraft, Ltd., realizing that many enthusiasts would like to possess a similar model, purchased the exclusive World rights and arranged to manufacture it as a Super Construction kit, under the personal supervision of its designer. Every wood part in this Kit is shaped out ready to fit together, every wire part is formed to shape; the airscrew is carved out, requiring finishing only, and the famous free-wheel and rubber tensioner device are supplied complete. Full size drawings are, of course, included.

Send the coupon for the new coloured 8-page leaflet showing all FROG ranges including the PENGUIN series.



REG. TRADE MARK

THE FROG COMPETITION MODEL

Entirely new model specially designed to give high performance and for use in S.M.A.E. competitions. Obtainable ready to fly..... **49/6**

Or as a Construction Kit..... **15/-**

Other FROG Construction Kits from..... **2/6**

OBTAINABLE AT ALL GOOD TOYSHOPS AND STORES

FROG MODEL AIRCRAFT

FROG Model Aircraft are covered by World Patents granted and pending. Made in England by International Model Aircraft Ltd. Sole concessionaires:

LINES BROS. LTD., TRI-ANG WORKS, MORDEN RD., MERTON, LONDON, S.W.19

COUPON To Lines Bros. Ltd. (Dept. 6), Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled "Frog" Pilot Badges.

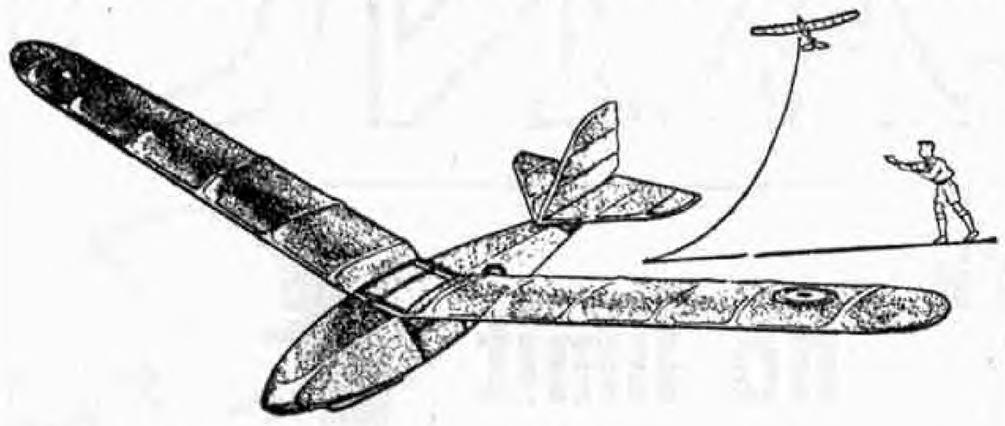
Name.....

Address.....

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Please write in block letters. 8/37

HIGH PERFORMANCE SAILPLANE



This splendid model from the **SCUD** range performs exactly like a full-scale Sailplane. It is the only British-made machine of its type made, and when correctly trimmed and under suitable weather conditions has soaring flight of up to ten minutes. This is definitely the machine for the enthusiast and will provide hours of instructive flying. **No propeller to wind. Nothing mechanical to go wrong.** Totally enclosed fuselage, mainplane and tail unit double surfaced, covered jap silk and doped silver. Skid under-carriage. Includes new catapult launching gear. Gliding angle in calm air, 1 in 15. Span 38". Price **17s. 6d.**

SEND NOW FOR ILLUSTRATED CATALOGUE DESCRIBING OUR 1937 RANGE

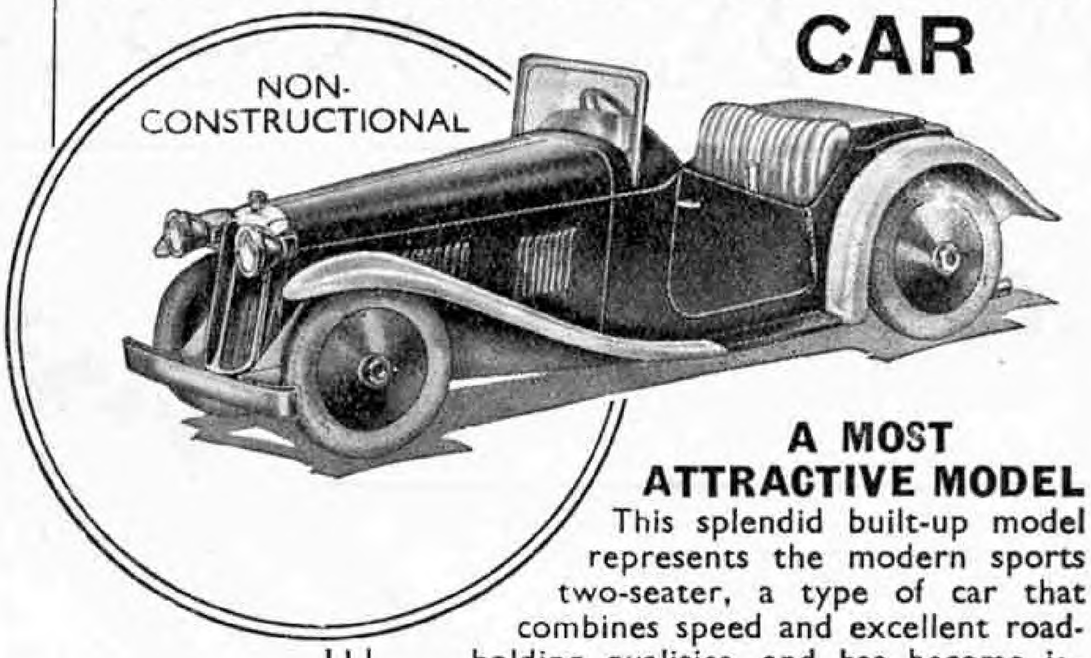
Stocked by leading dealers throughout the kingdom

SCUD MODELS LTD.

Lovaine Crescent Model Works, Newcastle-upon-Tyne

A REALISTIC

TWO-SEATER SPORTS CAR



The model is beautifully made and finished, and is richly enamelled in Blue and Cream

A MOST ATTRACTIVE MODEL

This splendid built-up model represents the modern sports two-seater, a type of car that combines speed and excellent road-holding qualities, and has become increasingly popular during recent years. Speed is suggested by the sweeping lines of the bodywork and mudguards, together with the sloping radiator and wind-screen.

The model faithfully resembles its prototype in all important respects. It is complete in itself, no constructional or assembly work being required. It steers from the wheel and is fitted with a strong clockwork motor that gives a long and steady run.

Overall dimensions: Length, 8½ in.; Width, 3¼ in.; Depth, 2⅞ in.

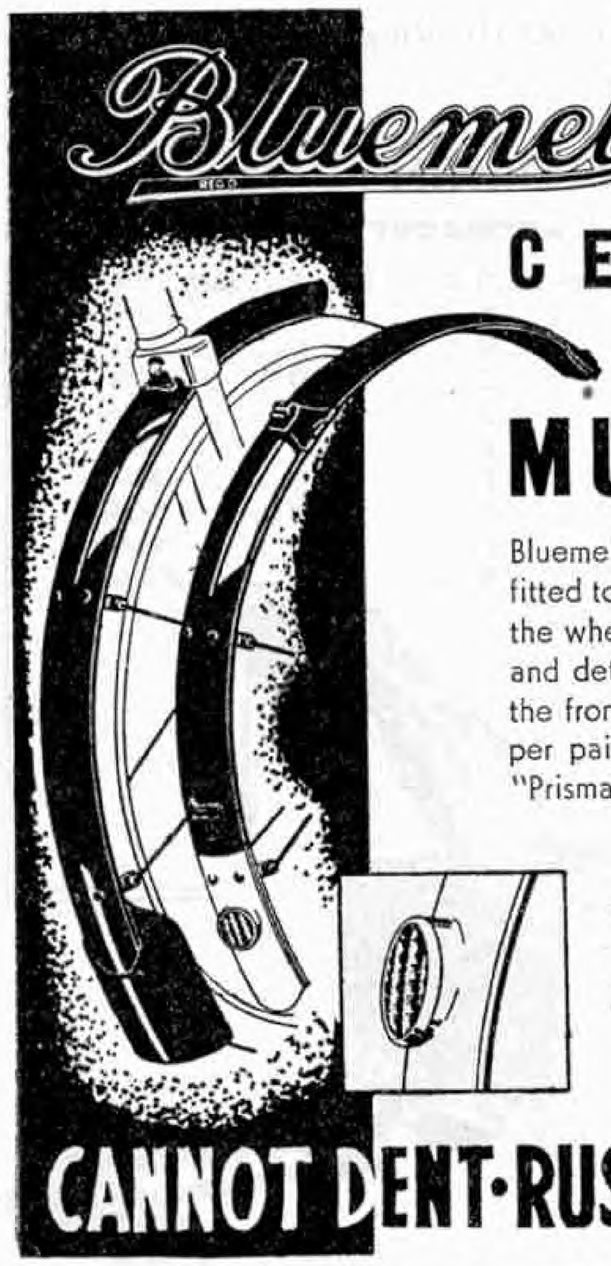
Price **6'6**

Manufactured by

Meccano Ltd., Binns Rd., Liverpool 13

Bluemel's

CELLULOID MUDGUARDS

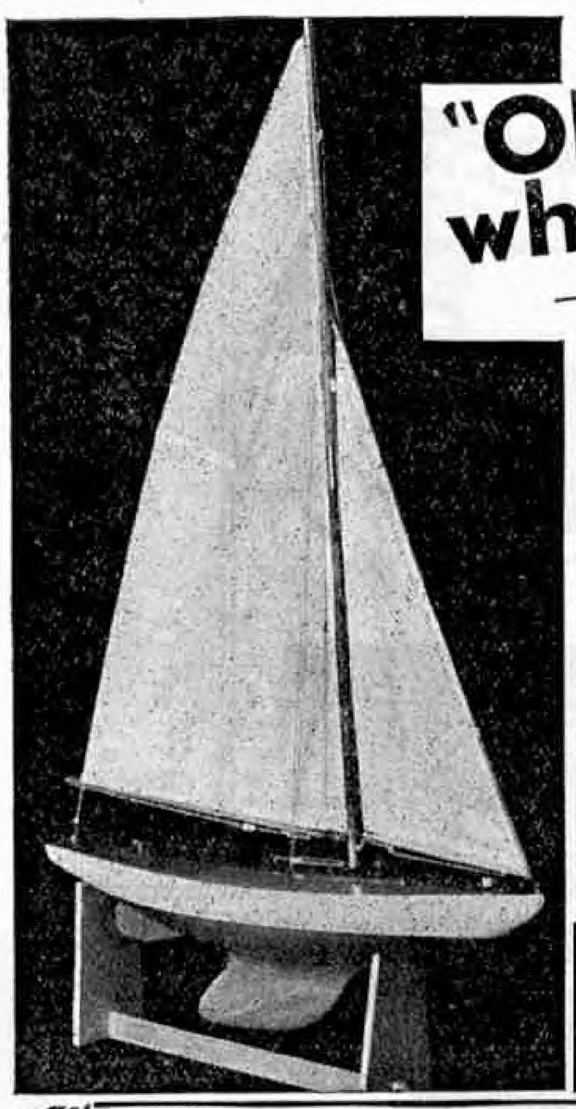


Bluemel's Celluloid Mudguards can be fitted to any cycle without interfering with the wheel adjustment. Quickly adjustable and detachable, with built-in mud flap on the front guard, in black. Prices from **4/8** per pair. Colours 1/- extra. If fitted with "Prismatic" Reflector built-in, as illustrated, 1/- extra.

Write for Bluemel's pocket catalogue containing interesting cycling data.

CANNOT DENT·RUST·CHIP

BLUEMEL BROS. LTD.
DEPT. 27, WOLSTON
Near COVENTRY



"Oh Boy what a yacht! —it's Clyde-built"

This miniature Yacht is built to a standard of accuracy and finished to a degree of perfection never before achieved. Get one of these fast, seaworthy Yachts; she'll win any event in her class.

Reduced Prices:

24" L.O.A. as photo, was 45/- **Now 37'6**
30" L.O.A. was £6 **Now £4-10**
36" L.O.A. was £9-9 **Now £8-15**

We pay carriage anywhere in U.K. *Satisfaction guaranteed.*

Fill in—tear out post coupon to-day for FREE catalogue

Clyde Craft Ltd. Busby Glasgow Scotland

Name .....
Address .....
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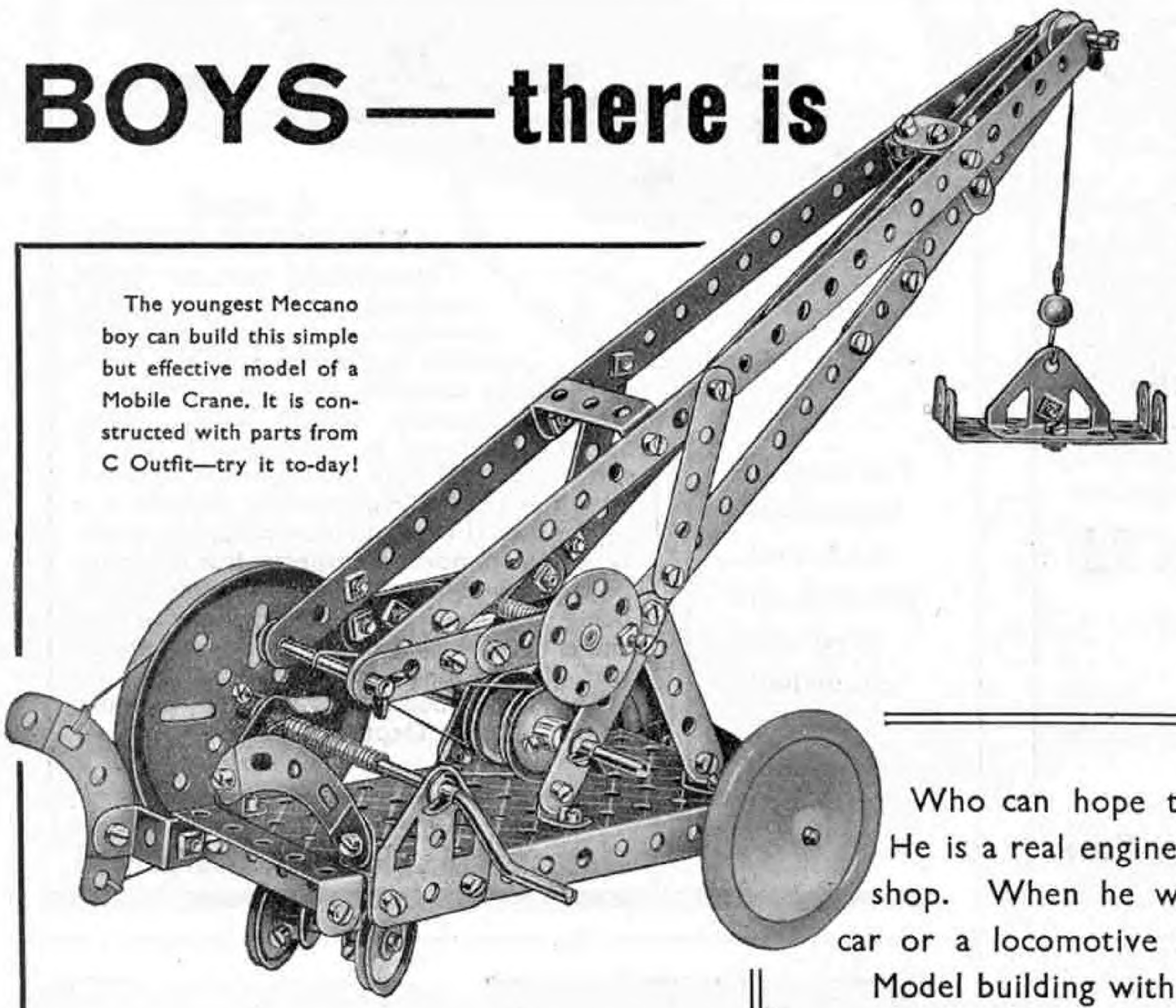
Write in BLOCK LETTERS. Post unsealed ½d. envelope. M.M.5.

howats

MECCANO

BOYS—there is no limit to the number of models you can build with Meccano!

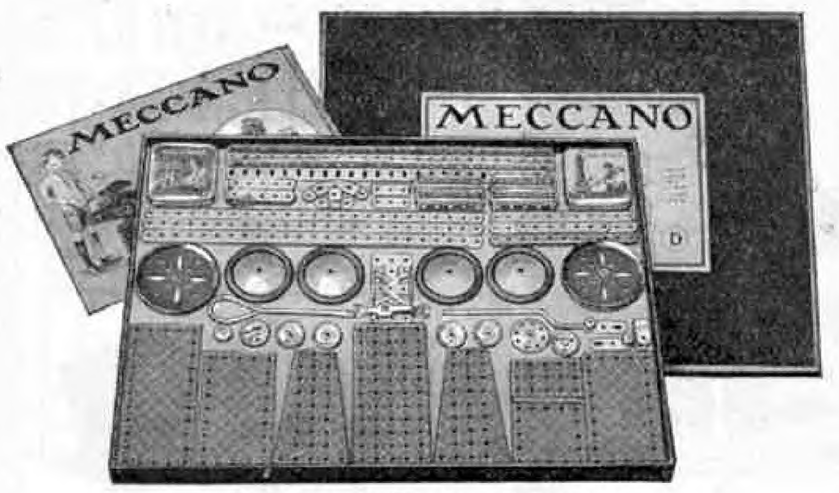




The youngest Meccano boy can build this simple but effective model of a Mobile Crane. It is constructed with parts from C Outfit—try it to-day!



A Meccano Outfit. Price 5/-



D Meccano Outfit. Price 15/-

Who can hope to have as many toys as a Meccano boy? He is a real engineer—his playroom is an engineering workshop. When he wants a truck, a crane, a bridge, a motor car or a locomotive he builds one with his Meccano Outfit.

Model building with Meccano is the most thrilling hobby in the world for boys.

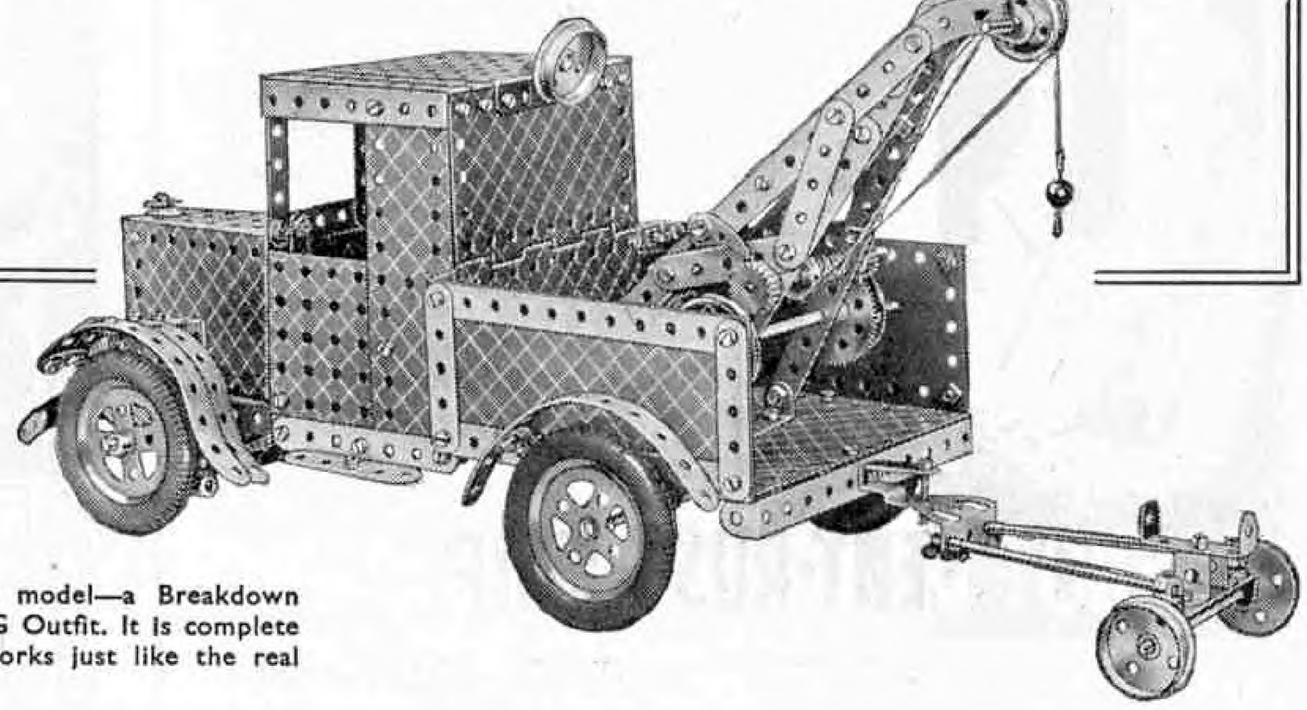
Prices of Meccano Outfits

COMPLETE OUTFITS

O	Outfit	each	3/6
A	,, ...	,,	5/-
B	,, ...	,,	7/6
C	,, ...	,,	10/-
D	,, ...	,,	15/-
E	,, ...	,,	20/-
F	,, ...	,,	30/-
G	,, ...	,,	55/-
H	,, (Carton)	,,	72/6
Hw	,, (Cabinet)	,,	97/6
K	,, (Carton)	,,	132/6
Kw	,, (Cabinet)	,,	157/6
	,, ,, ...	,,	400/-

ACCESSORY OUTFITS

Oa	converts	O	Outfit into	A ...	each	1/6
Aa	,,	A	,, ,,	B ...	,,	2/6
Ba	,,	B	,, ,,	C ...	,,	3/-
Ca	,,	C	,, ,,	D ...	,,	5/6
Da	,,	D	,, ,,	E ...	,,	5/6
Ea	,,	E	,, ,,	F ...	,,	11/-
Fa	,,	F	,, ,,	G ...	,,	26/6
Ga	,,	G	,, ,,	H ...	,,	17/6
Ha	,,	H	,, ,,	K ...	,,	60/-
Ka	,,	K	,, ,,	L ...	,,	225/-



Here is another interesting model—a Breakdown Lorry built with parts from G Outfit. It is complete with crane and bogie and works just like the real thing.

MECCANO LTD. — BINNS ROAD — LIVERPOOL 13



See how easy it is to build!



Blackburn "Shark"

Trade Mark Regd.

THE FROG "PENGUIN" SERIES

of construction kits enable the enthusiast to build realistic non-flying scale models which are made to such accurate detail that it is almost impossible to tell a photograph of a model from one of the actual aeroplane.

Not only in appearance are they like the real thing but in such details as the cross-section of struts, etc.; the models would give correct results if tested in a wind tunnel.

These kits include all parts correctly shaped, full-scale drawings, cements, paints, etc. No tools whatsoever are required except for finishing the hull of the Short "Singapore III," which is only partly shaped. The series has proved so popular that several new models have been added to the range.

Send the coupon for the new coloured 8-page leaflet showing all FROG ranges including the PENGUIN series.

PRICES OF CONSTRUCTION KITS	
Percival "Gull"	3/-
Hawker "Fury"	3/-
Gloster "Gladiator" . .	3/6
Armstrong Whitworth "Scimitar"	4/-
Avro 504K	4/-
Blackburn "Shark" . .	5/6
Airspeed "Envoy" . . .	6/-
DeHavilland "Diana" . .	7/6
Short "Singapore III" Flying Boat	15/-
Hangar Kit	7/6

OBTAINABLE AT ALL GOOD TOYSHOPS AND STORES

FROG SCALE MODEL AIRCRAFT

FROG Model Aircraft are covered by World Patents granted and pending. Made in England by International Model Aircraft Ltd.

Sole Concessionaires:

LINES BROS. LTD., Tri-ang Works, Morden Rd., Merton, London, S.W.19

COUPON To Lines Bros. Ltd. (Dept. 5), Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled "FROG" Pilot Badges.

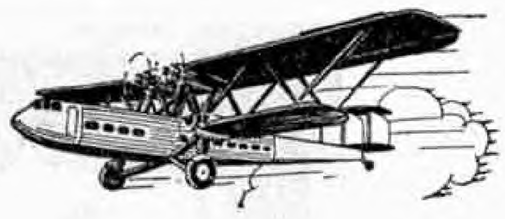
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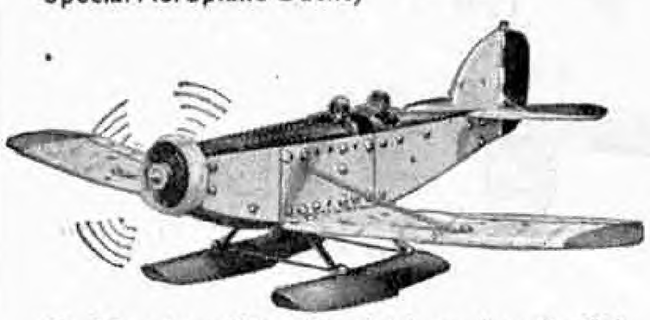
Please write in block letters. 8/37

AEROPLANE CONSTRUCTOR OUTFITS





Light Biplane (No. 1 Special Aeroplane Outfit)



Civil Seaplane (No. 2 Special Aeroplane Outfit)

Boys! build your own model aircraft

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise the different types of machines at a glance. These fine Constructor Outfits contain a range of aeroplane parts by means of which boys are able to design and build their own Aeroplanes quite easily.

The illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low wing Monoplanes, Biplanes, Seaplanes and many other interesting types.

Price List of Aeroplane Outfits

Standard Series.

No. OO Outfit	... 3/3	No. 1 Outfit	... 7/6
No. O Outfit	... 4/6	No. 2 Outfit	... 12/6

Special Series.

No. 1 Special Outfit **12/6** No. 2 Special Outfit **21/–**

Note. The parts in the No. OO and No. O Outfits are not intended for use with the larger Outfits.



No. 2 Special Aeroplane Outfit. Price 21/–

No. 1 AERO CLOCKWORK MOTOR

This Motor fits into the fuselage of models made with No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfits. It will rotate the propeller at high speed, thus adding to the realism of the model. Price **1/9**

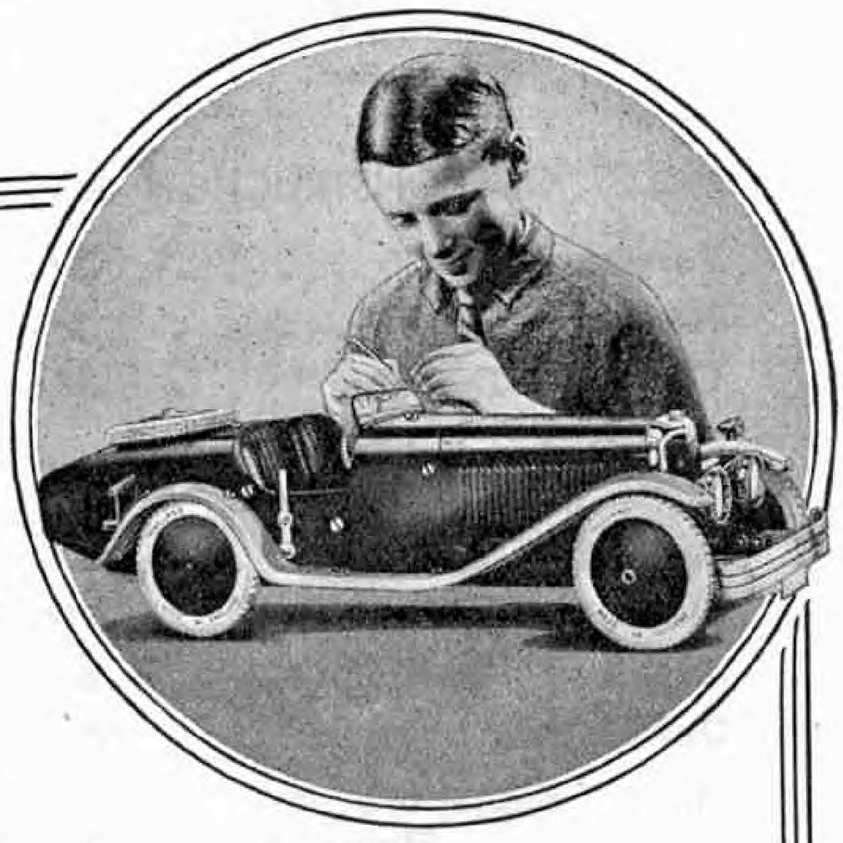
No. 2 AERO CLOCKWORK MOTOR

In addition to rotating the propeller, this Motor drives the landing wheels of No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfit models, making the machines taxi along the floor in a most realistic manner. Price **3/6**

MOTOR CAR CONSTRUCTOR OUTFITS



You will be keen to have one!





No. 1 Motor Car Constructor Outfit. Price **10/–**

No. 1 MOTOR CAR CONSTRUCTOR OUTFIT

The motor car models that can be built with this Outfit are perfect examples of miniature automobile construction. Think of the fine fun you could have building these wonderful models, each one of which faithfully resembles its prototype.

No. 1 Outfit is supplied complete with powerful Clockwork Motor. Price **10/–**

No. 2 MOTOR CAR CONSTRUCTOR OUTFIT

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the model illustrated on the right.

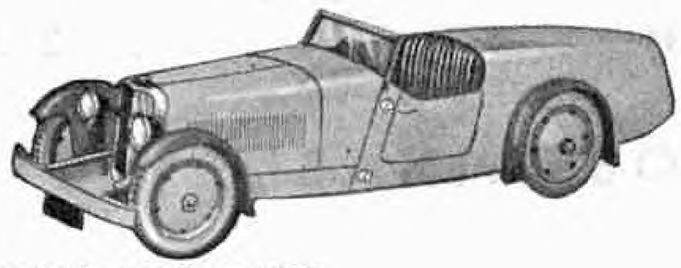
A powerful Clockwork Motor that gives a run of 150 feet on one winding is included in the Outfit. Price **20/–**

MOTOR CAR LIGHTING SET

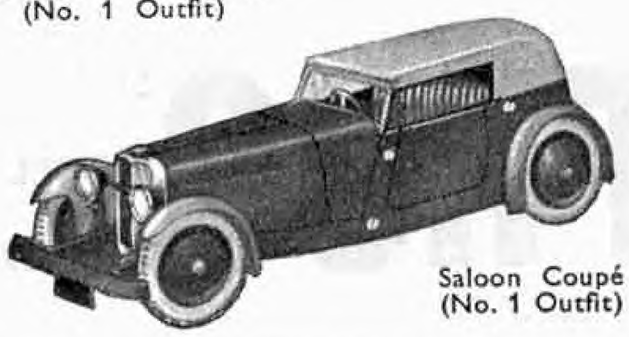
With this Lighting Set the headlamps of Motor Car models built with the No. 2 Motor Car Outfits can be electrically lighted. Price **2/6**

MOTOR CAR GARAGE

This realistic Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5 in. Length 13 in. Width 7¾ in. Price **5/6**



Light Sports Two-seater (No. 1 Outfit)



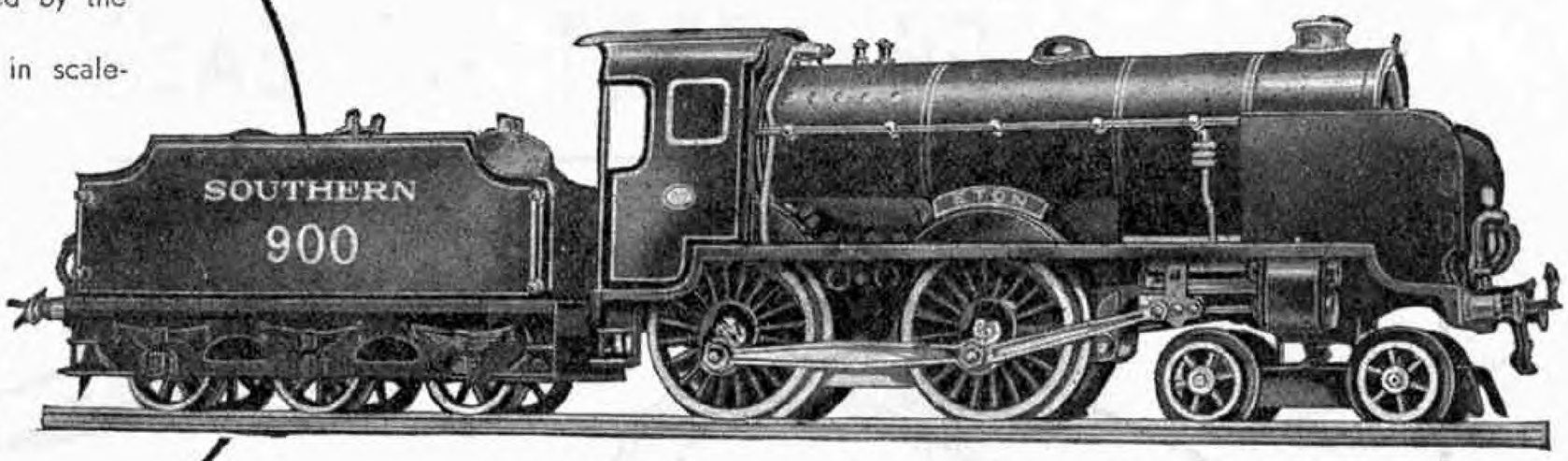
Saloon Coupé (No. 1 Outfit)

HORNBY ELECTRIC & CLOCKWORK TRAINS

This is a fine scale model of the first member of the famous "Schools" class, perhaps the most popular series of locomotives ever produced by the Southern Railway Company.

All who are interested in scale-model locomotives, and especially "Southern" enthusiasts, will welcome the "ETON" both for its beauty and its fine performance. It has a 20-volt motor designed for running from alternating current mains supply through a Transformer. It is fitted with the famous Hornby REMOTE CONTROL.

"ETON"



E420 "Eton" (20-volt electric) Automatic Reversing. Price **42/6**
No. 4c "Eton" Clockwork ... ... Price **35/-**
Tender ... ... Price **6/-**

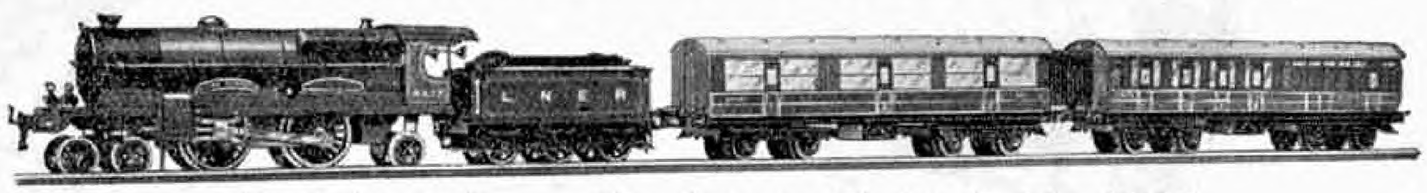
A SELECTION FROM THE 1937 RANGE OF HORNBY TRAIN SETS

You have spent many happy hours watching real trains at work. Now start a railway of your own and enjoy the thrill of operating Engines, Coaches, Wagons, Signals and Points on actual railway principles. It's the most fascinating pastime in the world!

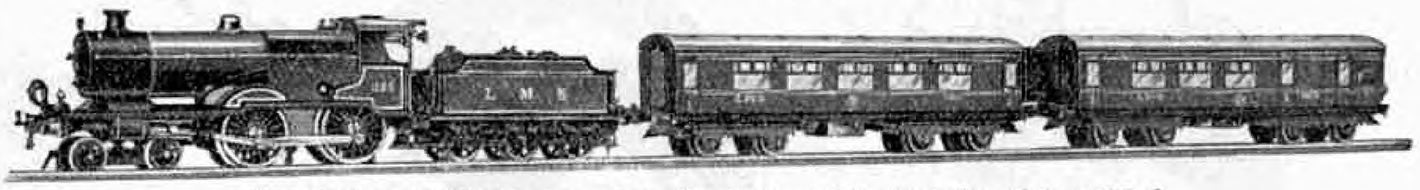
From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in practically every detail. There are Locomotives for all duties, driven by electric motors or by clockwork. There is Rolling Stock of all kinds including Pullman Cars, ordinary Coaches and Guard's Vans for passenger services, and numerous Wagons and Vans for freight working.

The Accessories are now better than ever before, while with the Rails, Points and Crossings an endless variety of layouts can be constructed, both for Electrical and Clockwork Trains.

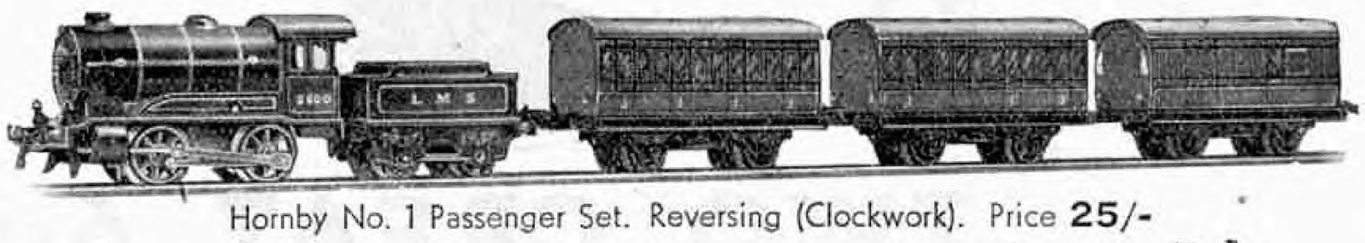
Hornby Train Sets are available at prices ranging from **15/-** to **75/-** for Electric models and **4/11** to **65/-** for Clockwork models.



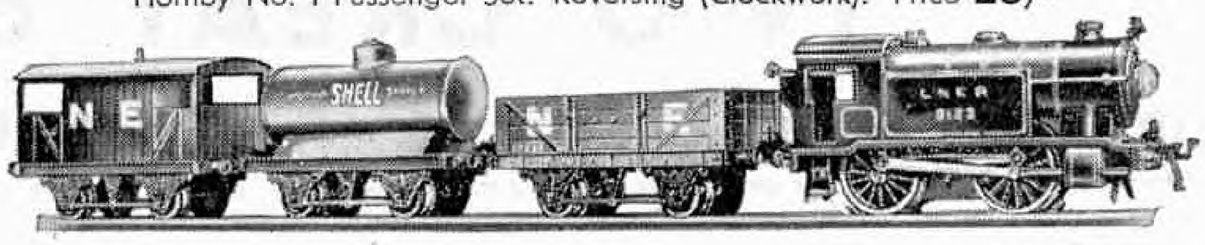
Hornby No. 3c Passenger Set. Reversing (Clockwork). Price **47/6**



No. 2 Special Passenger Set. Reversing (Clockwork). Price **52/-**



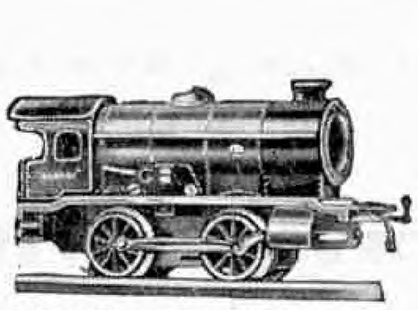
Hornby No. 1 Passenger Set. Reversing (Clockwork). Price **25/-**



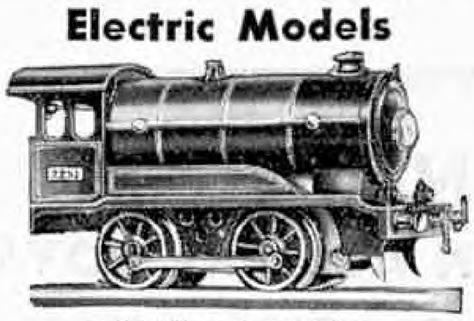
Hornby E120 Special Tank Goods Set. Reversing (20-volt Electric). Price **42/-**

A SELECTION FROM THE RANGE OF HORNBY LOCOS

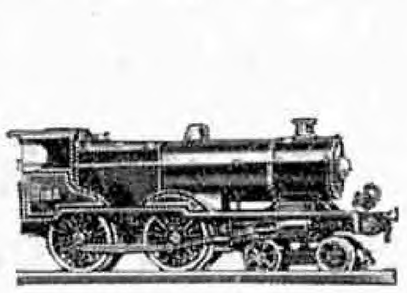
Electric Models



EM120 (20-volt) or EM16 (6-volt) ELECTRIC LOCOMOTIVE

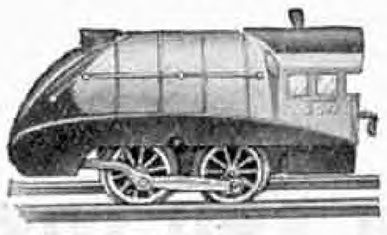


EO20 (20-volt) ELECTRIC LOCOMOTIVE

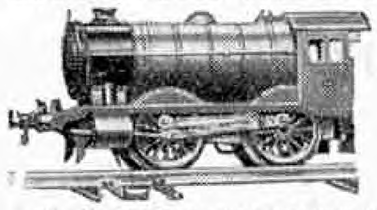


E220 (20-volt) SPECIAL ELECTRIC LOCOMOTIVE

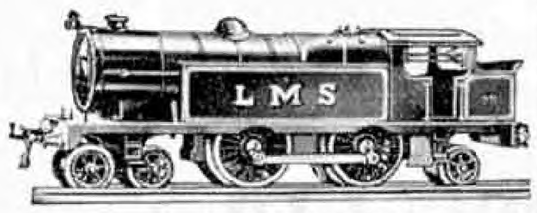
Clockwork Models



No. O "SILVER LINK" LOCOMOTIVE



No. 1 SPECIAL LOCOMOTIVE



No. 2 SPECIAL TANK LOCOMOTIVE

Electric Models

EM120 (20-volt) or EM16 (6-volt) Locomotive (non-reversing). Price **8/6**

EO20 (20-volt) Locomotive (reversing). Price **22/-**

E220 (20-volt) Special Locomotive (automatic reversing). Price **37/6**

Clockwork Models

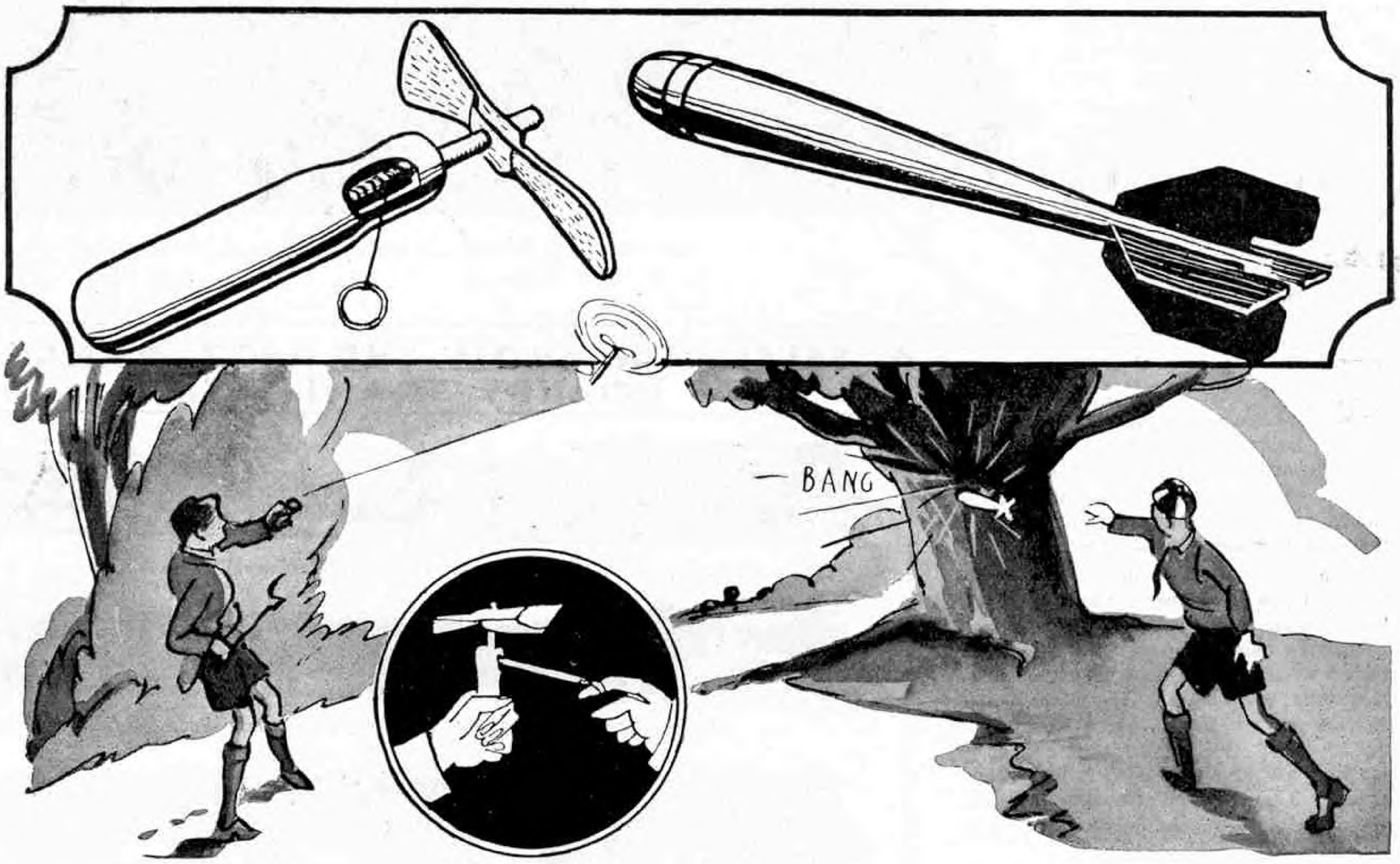
No. O "Silver Link" (reversing). Price **3/6**

No. 1 Special Locomotive (reversing). Price **17/6**

No. 2 Special Tank Locomotive (reversing). Price **21/-**

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NEXT MONTH: "THE DAY'S WORK OF A DIVER." PUBLISHING DATE: 1st SEPTEMBER

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
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Vol. XXII. No. 8
August, 1937

With the Editor

High-Speed Railway Travel

I am sure that every reader will be interested this month in the account by *"Railway Engineer"* of the trial run of the London Midland and Scottish Railway's *"Coronation Scot."* By invitation of the company I had the privilege of travelling in the train on that occasion, and the experience will live in my memory for many a long day. My two most outstanding impressions of the journey were the astonishingly smooth running throughout, affording wonderful testimony to the design and construction of the coaches, and the perfect condition of the track; and the obvious ease with which *"Coronation"* hauled us along, showing clearly that even at 114 miles per hour she was far from being "all out." This locomotive is evidently as efficient as she is beautiful.

Next month I hope to give a description of the *"Coronation"* streamlined train of the London North Eastern Railway.

Many readers have written to ask me how *"The Coronation Scot's"* great run compares with the speed attained with Diesel traction. I intend to devote an article to this subject very soon, and here I will mention only a United States train, the *"Super-Chief"* express of the Atchison, Topeka and Santa Fé Railroad. This train, on its journey from Los Angeles to Chicago, is booked to cover the 202.4 miles from La Junta to Dodge City in 145 minutes, giving an average speed of 83.7 miles per hour. The *"Super-Chief"* is a Pullman train hauled by a Diesel-electric locomotive, and makes one run in each direction every week.

Air Routes Across the Arctic

Three Russian airmen have accomplished the longest flight ever made. They left Moscow early on the morning of Monday, 12th July, and in the afternoon of the following Wednesday they descended in a field at San Jacinto, near Los Angeles in California. The distance covered during this flight of more than 62 hours was about 6,750 miles, which is nearly 1,000 miles more than the previous record, made in 1933 by the French airmen Codos and Rossi.

One of the most remarkable features of the flight was that the greater part of it was made over the snow and ice of the Arctic regions, and the airmen actually flew over the North Pole. In the previous month three other Russian airmen had made a similar flight that also ended in the United States, and the two journeys were made with such ease that the possibility of travelling across the world by way of the Pole seem to be established. Some day the North Pole may become one of the world's great air junctions! I see that the three record-breaking Russians are now preparing to fly round the world by way of both North and South Poles.

It is curious to find that the shortest routes from Europe to the Pacific shores of America and to Japan cross the Arctic Ocean. For instance, from Liverpool to Yokohama is 11,000 miles by ordinary routes, but the distance between the two cities by air line across the Pole would be only about 6,000 miles.

Flying is not necessarily more dangerous over the ice-bound ocean than in warmer regions. The Russian airmen do not seem to have encountered any special difficulty during their record flight. Ice did form on the wings of their machine, but only when flying at a great height over the Rocky Mountains. If proper surveys are made and a constant patrol can be maintained, it may even be safer to fly over the Arctic than over the Atlantic or the Pacific.

The World of To-morrow

The inventor, the scientist and the engineer are always striving to produce new marvels, and the world of to-morrow promises to be one of mechanical and electrical marvels compared with which the machinery of to-day will seem crude and clumsy. It is not easy to picture this world as it will be, for at any moment some entirely new development may come along that will bring about unexpected changes, as the discovery of the electric motor and the dynamo did about a century ago. We can form some idea of what will happen by keeping careful watch on the work of inventors, however, and the article on page 452 of this issue suggests some of the advances that may be made in the generation of power and in methods of travel. Invention of course covers a much wider field than this, and I hope shortly to publish a further article on suggested inventions that at present seem to be merely fantastic, but which in time may lead to wonderful developments.

Even in the fairground the inventor is hard at work devising new amusements of an increasingly thrilling kind. I wonder what the people of a century ago would think of our present-day amusement parks! The only merry-go-rounds familiar to them were driven by man or horse power, and the few specimens of this kind now remaining are eagerly sought for preservation in folk museums. I suppose our own roundabouts and switchbacks will seem equally tame to the people of to-morrow. They probably will enjoy even swifter and more exciting movements than that of the "Loop-O-Plane," the sensational "ride" described in the article on page 462 of this issue.

114 m.p.h. on the L.M.S.

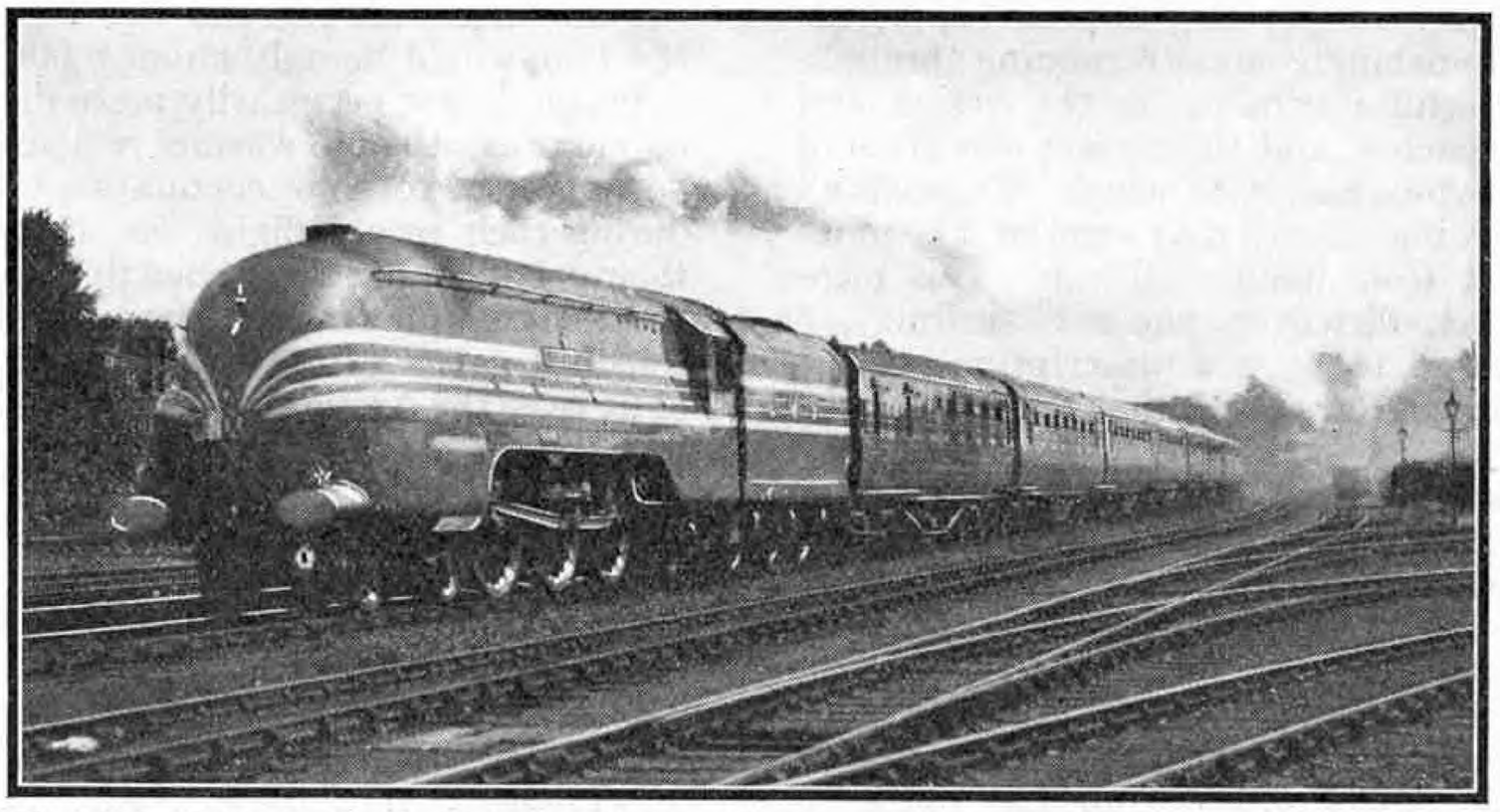
"The Coronation Scot's" Great Runs

By a Railway Engineer

THE L.M.S. streamlined era began most auspiciously on Tuesday, 29th June, when *"The Coronation Scot"* made a trial run from Euston to Crewe and back. The Editor of the *"M.M."* and I were privileged to travel by the train on this notable occasion, and to witness the attainment of the highest railway speed yet recorded in the British Empire—114 m.p.h. The record was however wrested from the L.N.E.R. streamlined engine *"Silver Fox"* only by the slender margin of 1 m.p.h., and the very closeness of the figures has made inevitable the keenest discussion on the relative merits of the rival engines.

Shortly after the event two young enthusiasts in hot debate on the subject appealed to me, and both, I fear, were a little taken back by my answer. The conditions on different lines are so dissimilar that one cannot possibly judge the relative merits of the rival engines on two isolated spurts such as these; but wherever run, speeds of over 110 m.p.h. bespeak a superbly designed locomotive. Although the two types differ considerably in principle, in detail, and last but not least in the shape of the streamlined casing, the honours are just about even when it comes to actual performance on the road.

At the same time the trial of *"The Coronation Scot"* was a very remarkable affair. Up till then the L.M.S. had never once claimed a maximum speed of 100 m.p.h. or more, although I believe it had been slightly exceeded on certain braking trials; whereas the L.N.E.R. have registered successively 100, 108, 112½, and finally the 113 m.p.h. of *"Silver Fox."* To break the record at the very first attempt was no mean achievement on the part of *"Coronation"* and her crew, and it was the result of a perfectly astounding acceleration in which speed rose from 85 to 114 in just eight miles!



The L.M.S. "Coronation Scot" near Queen's Park on the down run during the trial trip described in this article.

But I am discussing the results before the run itself. A load of eight coaches was taken, 263 tons tare and 270 tons with passengers. Nearly all the highest officials of the L.M.S. were on board, including Mr. W. A. Stanier, Chief Mechanical Engineer and designer of the engine and train, and Mr. F. A. Lemon, Works Manager at Crewe, under whose supervision the engine was built. *"Coronation"* was manned by Driver T. Clarke, best known of all L.M.S. enginemen to *"M.M."* readers, and Fireman Lewis, of Crewe; while with them on the footplate rode Mr. R. A. Riddles, Principal Assistant to the Chief Mechanical Engineer, and Inspector Miller of Willesden.

The special—"W.700" was our official designation—was booked to start at 9.50 a.m. but before we got away there was just time to go up on to the footplate and have a good look round. The cab arrangements are very similar to those of the "Princess Royals"; there is the same splendid view ahead from the cab glasses, though it seemed unusual to look out past a huge sloping blue wall. By far the most interesting feature of the cab fittings is the Hasler speed indicator, which is fixed just over the top of the reversing gear, right in front of the driver. This is of the Teloc type, and not only indicates the speed at any moment, but also the time the engine has been at work and the distance covered.

We made a beautiful start. *"The Coronation Scot"* went out of Euston with the smooth quiet efficiency of an electric train, and, accelerating in remarkable style up such a gradient, we topped Camden bank at exactly 30 m.p.h. Then, after taking the salute of crowds of waving, cheering enginemen as we passed Camden Sheds, Driver Clarke set about things in earnest. But although the acceleration out of Willesden was totally unlike that of any other train, it was not until we were through that junction that *"Coronation"* began to develop some real pace. We were then doing 65, but two miles farther on we were up to 76, and from that the engine steadily accelerated to 82 m.p.h. up the long 1 in 335 rise past Harrow. Watford, 17½ miles, was passed in the unprecedented time of 17 minutes, at 87½ m.p.h., and speed then settled down to a steady 80 to 81 m.p.h., on the ascent to Tring. There was a momentary drop to 79 in Northchurch tunnel, but apart from that we never went below 80 all the way up. Schedule time for the 31.7 miles from Euston to Tring was 30 minutes, but on passing the summit we were already 2¼ minutes early.

From this point onward the special schedule was fairly closely observed and the speed became rather more moderate. At several places, such as Linslade tunnel and through Wolverton, considerable reduction of speed had to be made on account of curves, and there was the usual 40 m.p.h. slack through Rugby; but on the other hand the Polesworth colliery district, which used to necessitate a 30 m.p.h. slowing on account of subsidences, is now de-restricted since the taking over of the pits by the railway company. The pace descended from the 80-85 m.p.h. order to a general average of 72-77, and caused the Editor to remark jokingly: "This is a very slow train!" And slow the pace seemed after that brillant start, although in point of fact we covered the 101.9 miles from Tring to Stafford in 82¼ minutes, an average of 74.5 m.p.h.

During this period I was very interested to observe how the exhaust steam was being thrown high over the carriage roofs. We were travelling in the front coach, and a time of fairly easy running was one in which some beating down of the steam might have been expected, especially as we were travelling against a stiff breeze on a day of somewhat humid atmosphere.

When *"Coronation"* first appeared, the shape of her streamlined casing was the subject of considerable comment. On the L.N.E.R. the external front-end of the "Silver Links" was specially constructed of a wedge shape in order to throw the exhaust clear; it is indeed more an aerodynamic device to create the air currents necessary for smoke deflection than true streamlining. It is for this reason that the same shaped front was applied to the latest Mikado engines, as in their case the advantages of streamlining as such would be negligible at the moderate speeds run over the Edinburgh-Aberdeen route. *"Coronation,"* however, is truly streamlined, that is her front end is designed to provide the least possible resistance to passage through the air. It was certainly very successful on the test runs, but it will be interesting to see what happens on such stretches as from Shap down to Carlisle, where the engine will be running for miles with the regulator in the drifting position, and scarcely any blast.

Now we were approaching the climax of the run, and it was not merely a wonderful demonstration of locomotive ability, but was also a piece of first-rate stage management. We rode gently round the curve at Trent Valley Junction, doing only 30 m.p.h.–10 m.p.h. under the speed limit—and went through Stafford five minutes early,

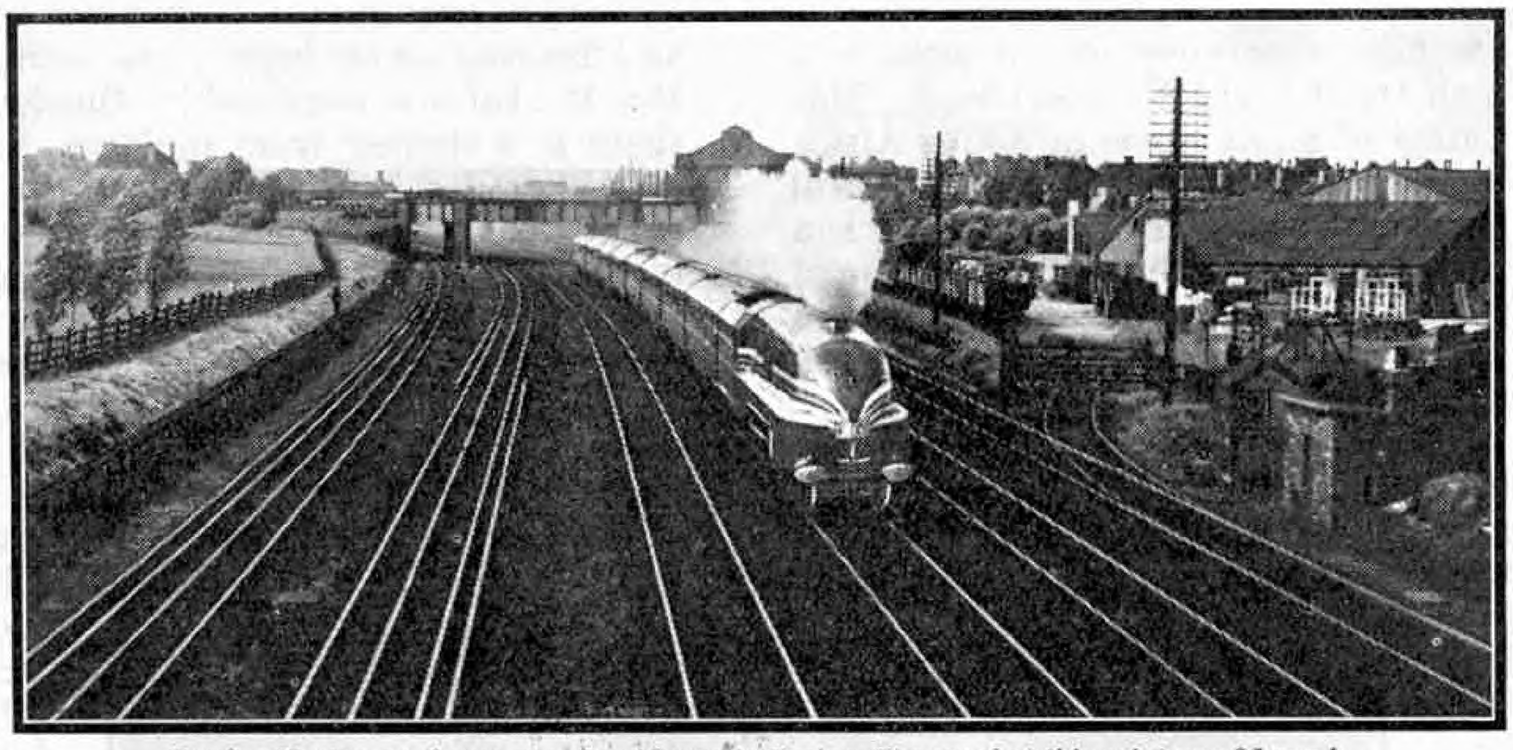
having run the 133.6 miles from Euston in 110 minutes. Then, without a sound from the engine, we recovered speed in most leisurely style, passing Great Bridgeford at only 58½ m.p.h. At Norton Bridge, however, now just ahead, there is a speed limit of 60 m.p.h.

We waited almost impatiently for Norton Bridge to be cleared, and after we were over the junction there was still not a sound from the engine. But then, quite stealthily it seemed, things began to happen; my stop-watch readings for the quarter-miles lessened rapidly, and although we were climbing a very gradual incline, 1 in 650, we were soon doing 80 m.p.h. A steepening of the grade to 1 in 398 made no difference now, the pace went on quickening until we swept over Whitmore summit at exactly 85 m.p.h. There was now just a suspicion of a purr from the engine, it might have been the exhaust and might not; but be that as it may, the next few minutes were simply electrifying.

It was all over so quickly that one formed no lasting impression. I was dimly conscious of the coach swaying gently from side to side; of the wheel beats coming faster and faster; of the Editor sitting opposite waiting almost breathlessly for me to call out the result of each stop watch reading; all the time my face was glued to the window sighting and clocking the whizzing mile-posts. Madeley, 2.6 miles beyond Whitmore, was passed at 97 m.p.h.; another mile and we were over the hundred; and from that, faster and faster, until I clocked two successive half-miles in precisely 16 seconds—112½ m.p.h.! Then we were tearing past Crewe sorting sidings, braking hard, and a moment later were at rest in the station. As soon as possible I was in the next compartment to compare watches with the official L.M.S. observers and that most expert of train timers, Mr. Cecil J. Allen. Our readings agreed to the nearest tenth of a second!

There is however always a possibility of a peak speed occurring between two stop-watch readings, and on this evidence the speed had almost certainly touched 113 m.p.h., and so tied with *"Silver Fox's"* record. On this trip it actually happened so, only the peak was higher than we first thought. When the chart on the speed recorder of the engine was examined, the top speed was shown clearly and indisputably to be 114 m.p.h.! In the thrill and excitement of record-breaking, however, what was perhaps the most astonishing feat of all was overlooked—we accelerated from 85 to 114 m.p.h. in *less than eight miles!* In view of these staggering feats of speed the fact that we made the fastest run ever known from London to Crewe was of incidental interest only; the 158.1 miles were completed in 129¾ minutes, an average of 73 m.p.h. from start to stop.

Apart from the record-breaking finish of the down journey, the finest running occurred on the return trip; there were no easy spells this time, and but for the observance of service slacks speed was maintained at or about 90 m.p.h. for the whole distance. From the various slowings there were some truly amazing accelerations, and the run is not only by far the fastest that has ever been made in this country over such a distance, but it also carries off the world record for steam traction in this respect.

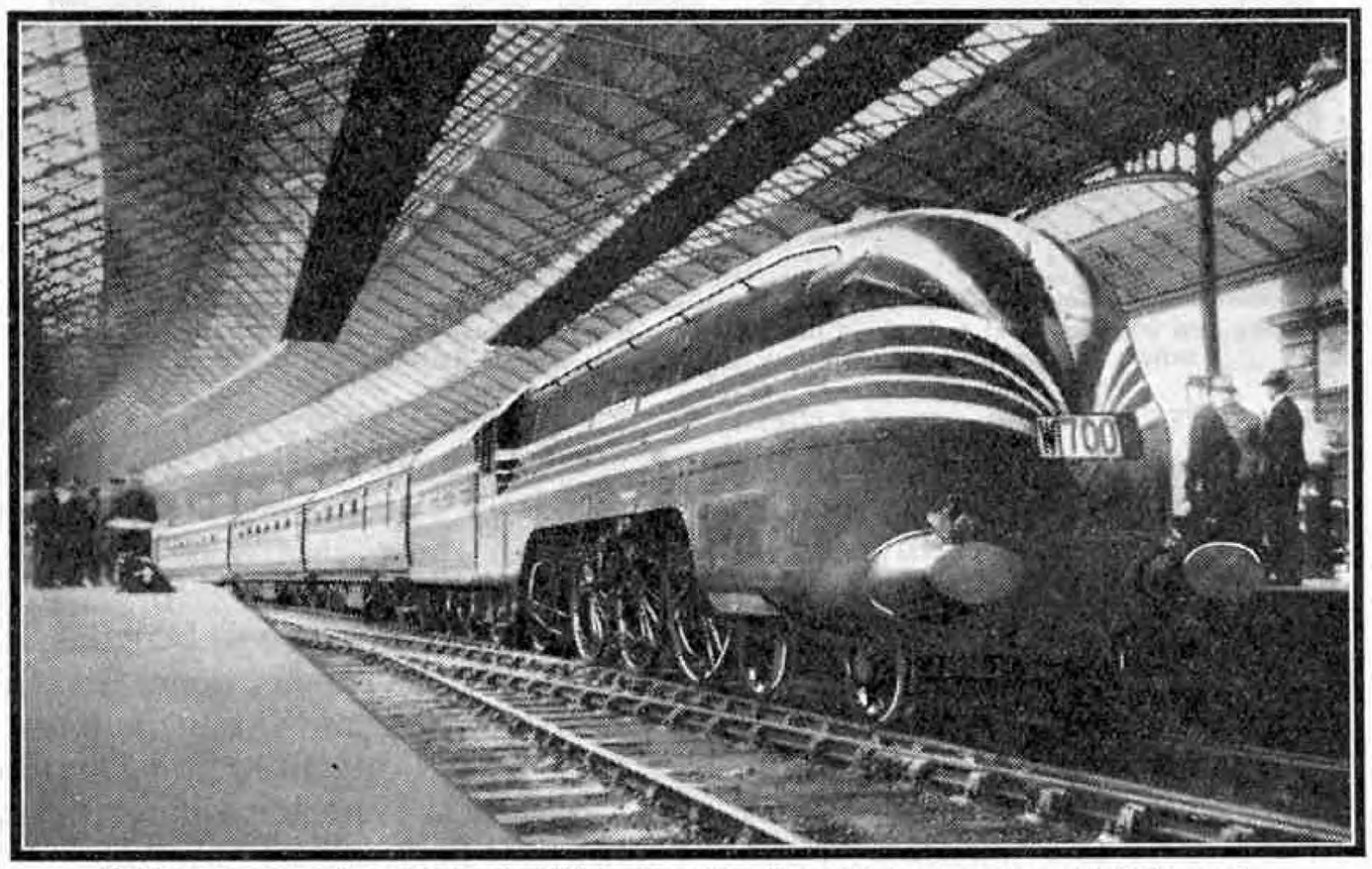


Passing Kenton on the up run, from Crewe to Euston. The speed at this point was 96 m.p.h.

We started away from Crewe in thrilling style, and up the 1 in 177 gradient of Madeley bank went merrily at 74 m.p.h.; hitherto we should have considered 60 m.p.h. brilliant here, even on such a celebrity as the *"Liverpool Flyer."* Before Norton Bridge 90 m.p.h. was reached, braking to 75 for the junction seemed like a severe slack for adverse signals, and we were through Stafford 24½ miles in a shade under 21 minutes. Passing over Trent Valley Junction at 30 m.p.h., Driver Clarke then treated us to an almost uncanny acceleration, for we entered Shugborough tunnel, 3¼ miles beyond the junction, at 81 m.p.h. We braked hard to 71 in readiness for the curve at Colwich, and then came a tremendous spell of sustained high-speed running.

We reached 90 m.p.h. at Rugeley, 92½ through Lichfield, an easing to 78 past the Polesworth collieries, and then, after a rapid acceleration on the up grades beyond, we had the unique experience of having to slacken severely for the curve through Atherstone. It was the same at several other points on the route, places that up to now have never been considered as "curves," but which require careful negotiation at such speeds as *"Coronation"* was now making. It took just four miles of level track for the engine to recover from 71 to 90 m.p.h.; Nuneaton, 60.9 miles from Crewe, was passed in 48½ minutes, and after a burst at 93½ beyond Shilton we were through Rugby in under the hour, the 75.5 miles having been wiped off in the remarkable time of 59½ minutes.

The 40 m.p.h. speed restriction through Rugby was most carefully observed, and then record-breaking was renewed with a vengeance. After a lightning acceleration to 75 m.p.h. up the rise to Kilsby tunnel, we were soon travelling at 90 m.p.h. again; indeed there was not one single piece of level or favourable road where we did not reach or exceed the ninety rate.



Back at Euston after covering the 158.1 miles from Crewe at an average speed of 80 m.p.h.

The running over the last 60 miles was a fitting climax to the day's proceedings. Over Castlethorpe troughs at exactly 100 m.p.h.; up the gentle rise past Bletchley going 89–93 m.p.h., and then a steady 87 m.p.h. up to Tring. At King's Langley speed was up to 99, and after easing to 84 through Watford tunnel *"Coronation"* wound up with a joyous 96 m.p.h. approaching Wembley. Sweeping through Willesden Junction at 85 m.p.h., we were still doing 80 at Kilburn, but the brakes were on hard when we entered Primrose Hill tunnel, and we emerged at a bare 40 m.p.h. to receive the cheers of Camden shed. So down the bank and into Euston, to complete the 158.1 miles from Crewe in the truly record time of 119 minutes.

During that amazing last lap the 57.4 miles from Blisworth to Willesden were reeled off in 38 minutes 26 seconds, an average of 89.8 m.p.h. throughout; while for 151 miles, from Betley Road to South Hampstead, speed averaged just 83 m.p.h.!

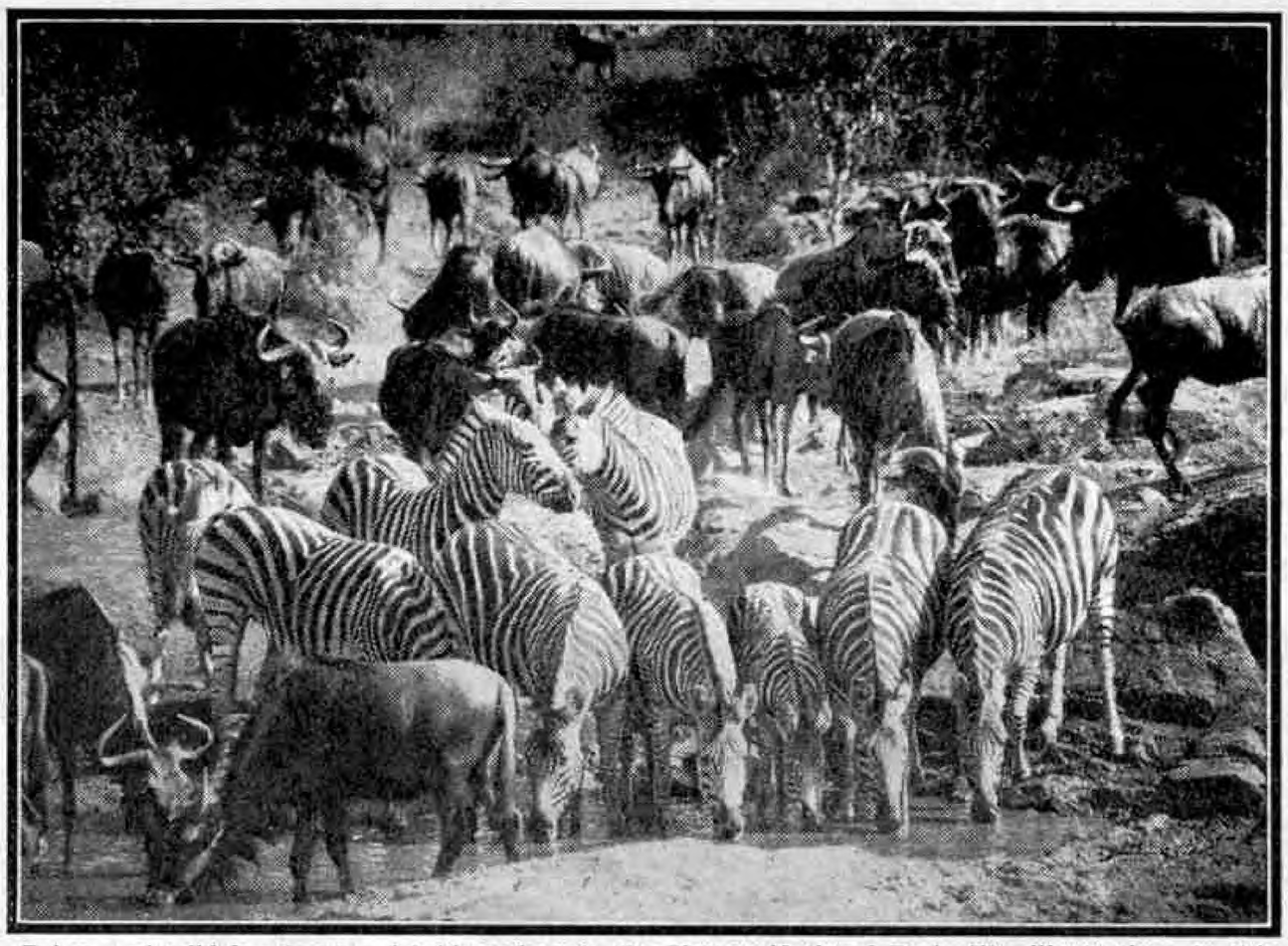
It only remains to add that the engine was in perfect trim on arrival. As for the bearings and moving parts, well, I felt the left-hand outside big-end, and the piston rod; they were both dead cold. A superb locomotive performance, and one of which Mr. W. A. Stanier, the men who built the engine, and Driver Clarke and Fireman Lewis have every reason to be proud.

South Africa's National Parks

Where Rare Wild Animals Are Preserved

ONE of the most wonderful journeys in the world is a motor trip through the Kruger National Park. This is the oldest and greatest of many areas in South Africa where wild creatures of various kinds roam in natural surroundings, completely undisturbed by hunters. It is a great stretch of country on the north-western border of the Transvaal, and was set aside as a game reserve in order to prevent various species of animal life of South Africa from becoming extinct.

The story of the Park began in 1898, when President Kruger, after whom it is named, issued a proclamation setting apart the land between the Crocodile and Sabi Rivers as a sanctuary for game. This was known as the Sabi Reserve, and from time to time it has been extended to protect animals that were not included in the old reserve, and to allow wider spaces for the herds of the various creatures in it. It now stretches from the Crocodile River in the south, along the Portuguese boundaries to the Limpopo and Rhodesia in the north.



Zebra and wildebeeste at a drinking place in the Kruger National Park. The illustrations to this article are reproduced by courtesy of the South African Railways and Harbours.

The Park is about 200 miles long and has an area of 8,000 square miles, so that it is a little larger than Wales. In its early days it was administered with the purpose of increasing the numbers of various animals native to the district. Some of these, among them the black and white rhinoceros, the elephant and the eland, had practically disappeared, and others, such as the buffalo, giraffe and the roan antelope were threatened with extinction. All the animals in the Park have flourished, and some of those that had vanished found their way into it from neighbouring territory. Thus the position has changed, and in 1926 the Park was established as a sanctuary for all time by the Government of the Union of South Africa, and can now be visited by all who are interested in this splendid remnant of unspoiled Africa.

The Park is a romantic land of forest and kopje, with reed fringed rivers and wide gorges. There are a few resident natives, who live under tribal law and are unspoiled by contact with civilisation, and other features of interest include the caves that are to be seen in nearly all the rock outcrops. A particularly interesting landmark is the ruin of the house of Albassini, on the south bank of the Sabi River, for this was the home of the first white man to live in the eastern veldt.

Throughout the summer the rivers flowing through the Park are swollen by tropical rains, flooding their banks and bearing away huge trees, animals and native huts. Roads also are impassable, the heat is oppressive and there is a danger from malaria. Except for an area of 100 sq. miles in the south, which is open all the year round, the Park therefore is closed to visitors in the height of summer. On the other hand the climate is ideal throughout the southern winter months, that is from May to October. The thermometer then seldom rises above 75 deg. F. There is little frost and the days are usually dry and exhilarating, and thousands of people take the opportunity of visiting this paradise for wild life.

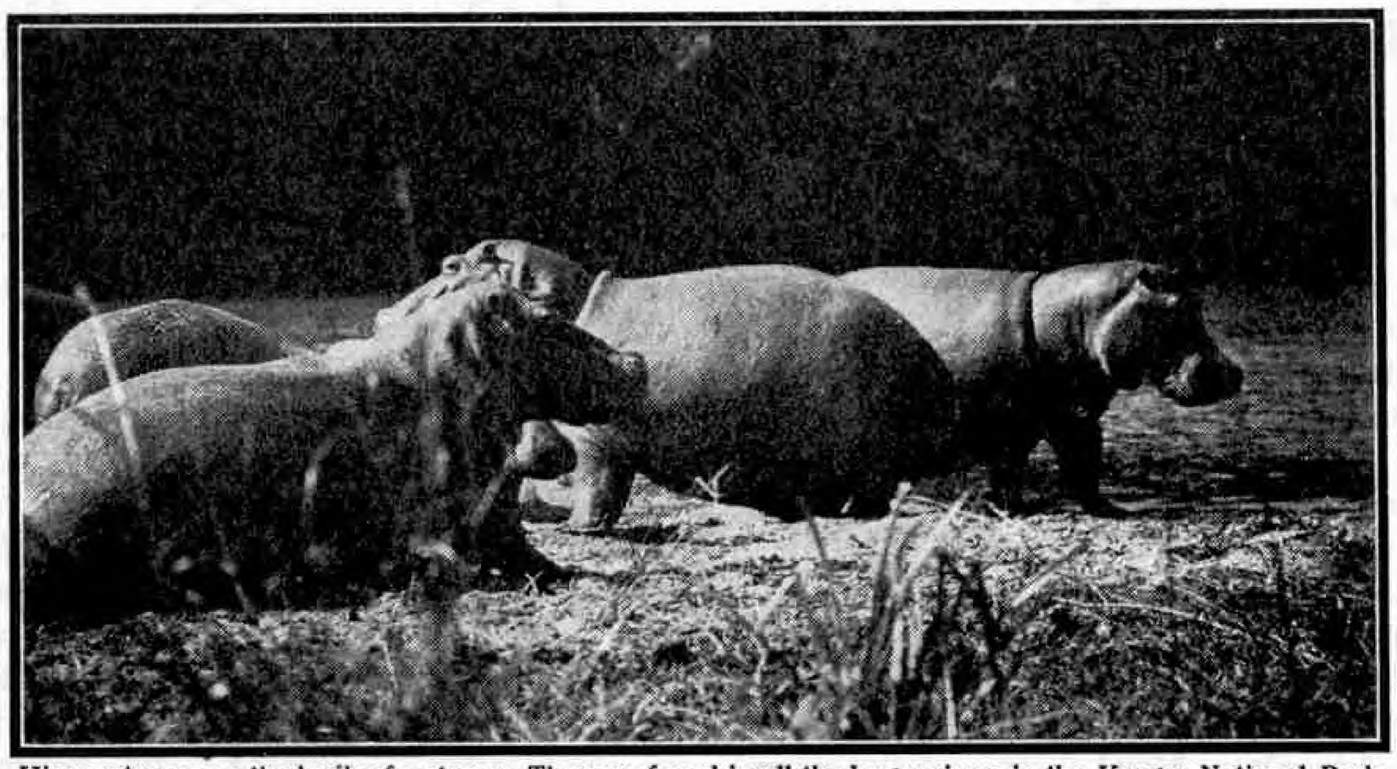
The best way in which to see the wonders of the Kruger National Park is to travel through it by car. Visitors are allowed to carry one firearm, but this must only be used in self-defence. It is sealed on entry by an officer of the Park, and a satisfactory explanation must be given if the seal is broken. Motor-cycles are prohibited, and there are various regulations against the use of gramophones and wireless after certain hours.

It is usual to enter at Komatipoort, at the southern end of the reserve, and from there to drive for 300 miles along well-made veldt roads to the most northerly point. The highest speed allowed is 25 m.p.h. Visitors who spend a night in the Park must stay at one of the rest camps placed at convenient points for daily expeditions to centres of interest. Most of the huts in these camps have concrete walls and thatched roofs, and are fitted with "riempie" or iron bedsteads, a hurricane lamp, rough benches, a washstand and table. A white supervisor is generally in charge, but there are native attendants engaged in ordinary camp work, such as making fires and carrying water.

The best time for seeing the animals in the Park is in the half light of early morning or late afternoon. They are for the most part so accustomed to motor cars that they take very little notice of them, and the traveller sees a bewildering variety of them with as little difficulty as in a Zoo. They are in their native haunts, however, and therefore are more natural and attractive. There are immense herds of zebra, and antelopes of all kinds. These include the graceful impala, the tsessebe, ungainly in appearance yet very swift, and the eland, which has reddish-brown fur and slow gentle movements and resembles the ox in appearance. Water-buck can be seen swimming powerfully in the cool river waters, and the most remarkable

of all perhaps is the kudu, with its long spiral horns and dainty gait.

Herds of buffalo are encountered, particularly in the south, and shaggy blue wildebeeste, with their ox-like heads and mane resembling that of the horse, are more numerous than any other animal in the Park. Huge giraffes try to hide behind trees as motors pass them, and the traveller is watched from the side of the road by troops of baboons, which are of particular interest because of their tameness and extraordinary intelligence. In the dense bush of the lower Sabi river valley, the traveller may catch sight of the black rhinoceros, which is fast disappearing from the game lands of Africa.

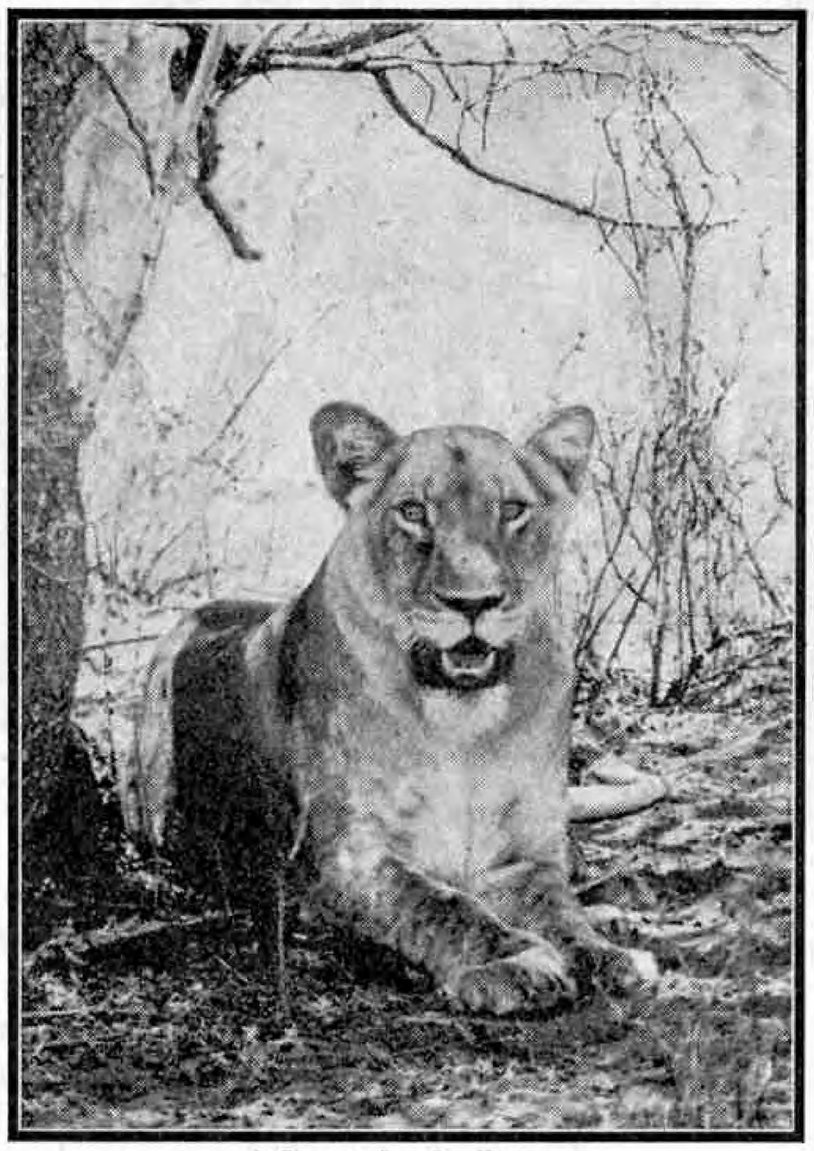


Hippopotamus on the bank of a stream. They are found in all the larger rivers in the Kruger National Park.

Some of the rivers in the Park are spanned by concrete causeways, but others have to be crossed on pontoons drawn by natives. The waters look cool and refreshing, but bathing would be very dangerous, for the streams harbour crocodiles, which can be best seen on cold winter mornings, basking on sandbanks in the rays of the sun. Some of them are over 14 ft. in length. Monitor lizards, which are so large that they are often mistaken for crocodiles, also pass an undisturbed existence in the rivers.

A trip through Kruger Park is incomplete unless it includes an encounter with the lion. The visitor may come upon him as he strolls along the road at evening, or as he dines upon his kill at the roadside, presenting a unique opportunity for the photographer. If he is not troubled he is unconcerned by the presence of a car, which he realises is not good to eat, but it is unwise for a traveller to leave the car and approach him, however tame he may appear. A lioness with cubs is even more dangerous, for she will attack without hesitation if anything seems to threaten her young.

An interesting creature that may be seen hurrying about its business is the mongoose. This is a small animal, not exceeding 24 in. in length, but it has courage and confidence out of all proportion to its size. It levies a heavy toll on snakes and rarely suffers defeat in its clashes with them. Those who dwell in or visit the Park have reason to be thankful to this little fighter, for snakes are very common throughout the Park. Many are of harmless varieties, but it is an unpleasant thought for the traveller that if he ventures into the long grass at the roadside he may encounter the deadly mamba, the ring-necked cobra or the puff or night adder. Fortunately these snakes spend their time mainly underground during the colder months, when the Park is open to visitors.



A fine study of a lioness.

It is impossible in a short article to mention all the creatures that find a home in this magnificent Park. These range from the cheetah and the wild dog to the elephant and the hippopotamus, and there is a wonderful variety of bird life. Great hawk eagles, with wings 9 ft. in span, and several other types of eagles are common, and the gruesome vulture can be seen, alert to swoop down on the remnants of a "kill." In addition there are game birds, such as the guinea fowl, bush pheasant, partridge and quail, and many smaller but interesting and attractive birds.

There is no lack of African elephants in the Kruger National Park, especially in the northern sections, for there are two main herds permanently located in it, and others have entered it from Portuguese territory. Near Port Elizabeth there is a reserve that has been set aside for the preservation of one species of these creatures. This is the Addo Elephant Park, and in it is the only surviving herd of Addo elephants. These are slightly smaller than the better known African elephants, and their tusks do not develop to the same length. In their reserve they are accompanied by an equally interesting remnant in a herd of old Cape buffalo, the only one left, and both will have an opportunity of growing, as have the herds of bison, now kept in the great reserves of Canada, that have developed from a small remnant of the few that once roamed the American prairies. An attempt also is being made to preserve the bontebuck, an antelope with long slender antlers and graceful carriage. Only one herd of 57 head of these creatures has survived, and a small park has been set aside for them at Bredasdorp, only 100 miles from Capetown.

In the semi-desert Kalahari country along the eastern border of South Western Africa, there is another National Park that is in strong contrast to the evergreen bush of the Addo Elephant Park. It is 3,000 sq. m. in area and includes great stretches of arid sand-dunes with open flats, dotted with low bushes and acacia trees. It is given over to the gemsbok, a large antelope with horns that sometimes attain a length of nearly four feet, and the springbuck, which is famous for its activity and powers of leaping. At one time there were almost incredible numbers of springbuck in South Africa, and in times of drought they migrated in great columns of hundreds of thousands, covering the ground in dense masses that swept away every living thing in their paths. Even lions attacking them were carried away in their furious rush.

A Giant Power Press

Motor Car Bodies Stamped Out in One Piece

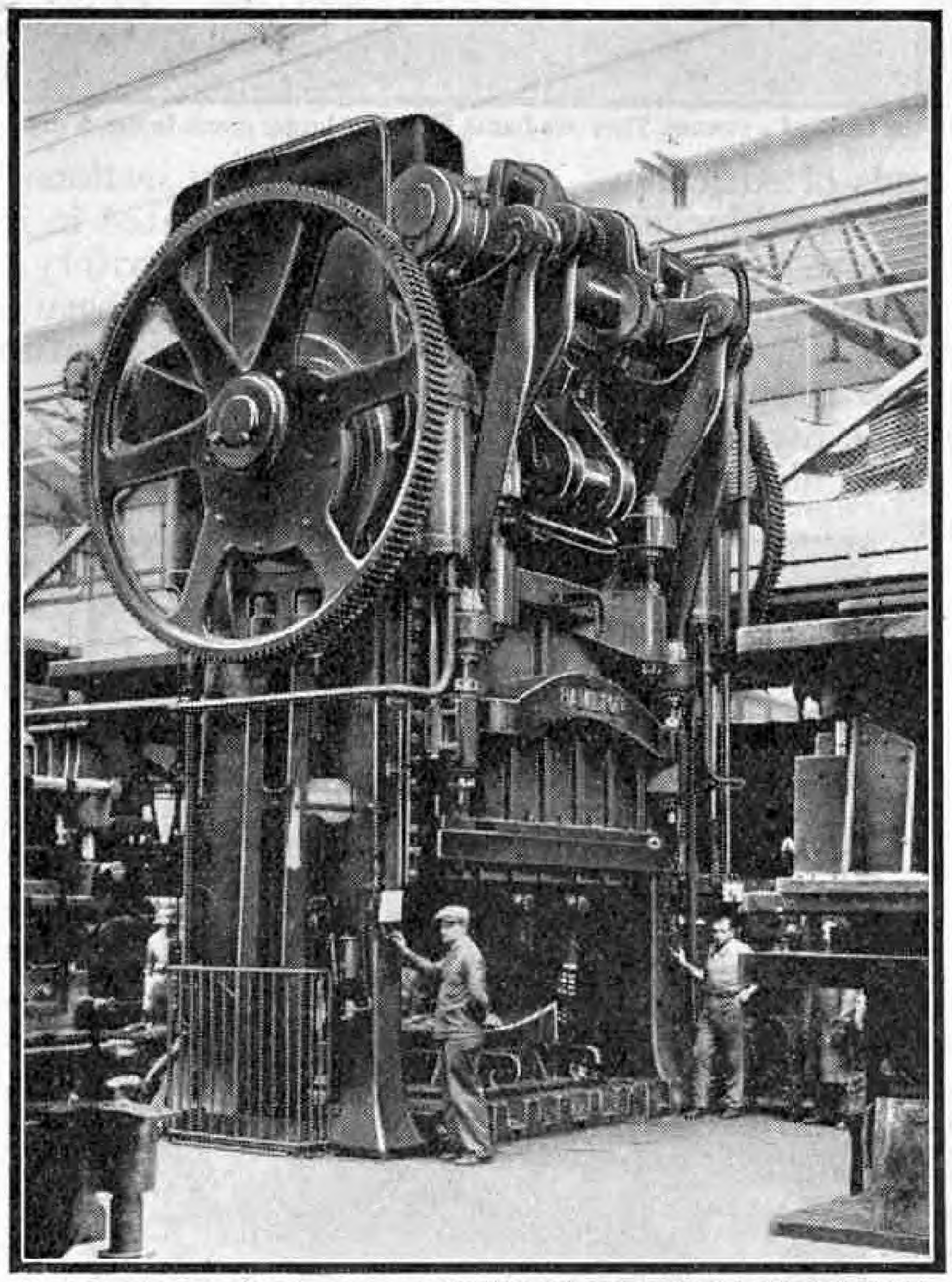
IN modern engineering workshops increasing use is being made of presses for stamping out sheet metal parts. In these a punch and a die made with the greatest accuracy to give the required shape are used. The die is fitted to the bed, or bolster, as it is called, of the press, and the blank sheet of metal is placed on it. The punch is fitted to the ram, the moving part of the press, and descends upon the metal sheet with great force, to press out the required part between the punch and the die.

Presses are of special importance in the production of motor car bodies. A large proportion of sheet metal is now employed in this work, wood being used exclusively for the interior fittings, and sometimes for flooring and sound-proofing. When sheet metal bodies for motor cars were first made they were built of a large number of pieces of sheet metal, which were stamped out separately and then assembled. By degrees larger parts have been introduced into body designs, and the total number of sections in each has been correspondingly reduced. This has brought with it a double advantage. On the one hand the amount of labour necessary for assembling has been diminished, and on the other there is not so much waste as with the older methods.

Certain builders have gone even further, and now produce in one operation a complete side of the body from a sheet of metal more than two yards in width. Our cover shows one of the largest of the presses erected for this purpose. It was built in the United States by the Hamilton Foundry and Machine Co., and installed in the press shops of the works at Sochaux of Peugeot Automobiles S.A., the famous French manufacturers of motor cars. The press is 36 ft. in height, and is installed in a pit so that it stands 26 ft. above ground. The pit is 13 ft. deep and its foundations contain 50 cu. m. of concrete, or enough to build a good-sized house. This massive base was necessary, for the giant press standing on it weighs 280 tons and the force of its downward stroke as it presses out parts is nearly 800 tons.

The press is of the triple-acting type, that is it has three rams. The main ram bears the punch and passes inside the second, which is fitted with a gripping device that holds the sheet of metal in position during the operation. The third ram is placed underneath the press and is operated in an upward direction by the two large connecting rods on the sides of the machine. This ram is brought into action when the first and the second have completed their strokes, and carries out an additional stamping operation. The illustration on this page shows a motor car door being stamped out, and in this case the third ram cuts out the window.

The machine was constructed in parts, which were shipped to Havre, and the transport of these from the port to the Peugeot works required special preparations because of their enormous weight and size. A special wagon was built to carry some of the sections, and the rail journey was carefully planned in order to make sure that there would be no hitch owing to lack of room in tunnels, on bridges or elsewhere. In one of the tunnels on the route the entire track had to be moved towards the centre line in order to allow the passage of a large section weighing 52 tons.



Stamping out a motor car door on the Hamilton press at the Peugeot works. Three of the four men who work the machine are seen with their fingers on the control. Photograph by courtesy of Peugeot Automobiles S.A.

In spite of its immense size the machine runs with absolute precision and smoothness, all its moving parts being balanced by means of cushions of compressed air. There are 144 points where it is automatically lubricated by pressure. The absence of oil or grease at any one of these points brings into action a safety device that prevents the machine from working at all.

The control of a powerful press calls for great care if accidents are to be avoided, and an ingenious scheme has been evolved in order to avoid trouble of any kind with the Peugeot press. This is set in motion by pressing electric buttons. There are four of these, one for each of the men normally at work on the machine, and movement is impossible unless each man is pressing the particular button of which he is in charge. When they are doing this they are at a safe distance from all moving parts, and run no risk of being trapped in any way. The press would stop immediately if one of them were to remove his hand before the movement was completed, so that they must remain in safe positions until the very end of the stroke.

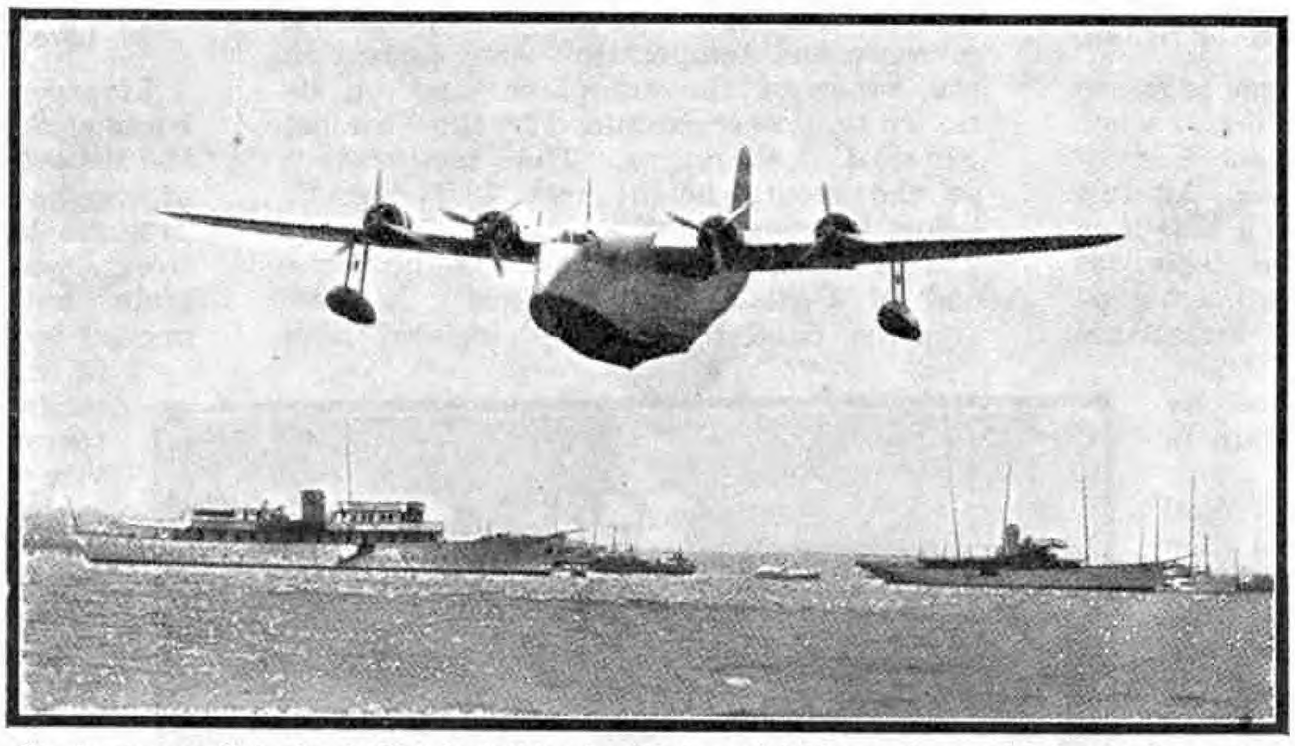
The usual plan followed in working with this giant machine is to stamp out the parts one at a time. The movement stops at the finish of the stroke, and the workers then withdraw the pressed piece and insert the next sheet of metal. This course is followed when making large sections, but the press can be made to work continuously when less difficult and bulky parts are being produced. Then the ram rises and falls continuously, making seven strokes every minute. In addition the machine can be set to make strokes of about 1/10 in. when setting or adjusting the tools in readiness for production.

The Transatlantic Air Route

Fine Flights by British and American Craft

ON 5th July last the Imperial Airways flying boat *"Caledonia"* carried out with brilliant success the first of a series of experimental flights across the North Atlantic. These flights are a necessary preliminary to the introduction of the regular service across the Atlantic Ocean that will connect this country with the air mail systems of Canada and the United States.

The *"Caledonia"* took off at Foynes, on the Shannon estuary, at 7.57 p.m., and after circling overhead quickly passed out of sight. Throughout the long night flight over the Atlantic radio messages from the machines were received regularly by the British Air Ministry and Irish Free State radio stations at Foynes. At the Imperial Airways offices in London the progress of the flying boat was plotted on a large chart of the Atlantic spread out on a table, small circles denoting the hourly positions of the machine. For three-quarters of the flight head winds of about 35 m.p.h. were encountered, and considerable drizzle; but as Newfoundland was neared the wind diminished and visibility improved, and 15 hr. 3 min. after leaving Foynes the *"Caledonia"* was over Botwood, Newfoundland. A perfect landing was made in brilliant sunshine and in the presence of a large cheering crowd.



The long-range flying boat "Caledonia" leaving the Imperial Airways base at Hythe, Southampton, for the air base at Foynes, on the Shannon estuary, prior to her Atlantic flight. The illustrations to this article are reproduced by courtesy of Imperial Airways Ltd.

The crossing was made at an average speed of 132 m.p.h., and this figure would undoubtedly have been much higher but for the continual head winds encountered. On arrival at Botwood the *"Caledonia"* had 900 gallons of petrol left, her engines having consumed 1,700 gallons. The substantial quantity left showed that even if much worse weather had been met the fuel supply would have been adequate.

The *"Caledonia"* is one of two Empire flying boats that have not been put into service on the existing Empire air routes, but have been reserved for experimental long-distance flights and research in connection with the trans-Atlantic scheme. Instead of being luxuriously equipped like the other machines, the interiors of these two are bare. The extensive radio equipment of the *"Caledonia"* is designed to provide communication with the British Air Ministry, the Irish Free State, Canada and the United States, and has been developed from that installed in the standard Empire flying boats. The six extra fuel tanks fitted in the *"Caledonia"* allow sufficient fuel to be carried for a non-stop flight of 3,000 miles in still air. All the fuel tanks are in the wings.

The construction of the Empire flying boats was fully described in the 1936 *"M.M.,"* but it may be mentioned again that they are 88 ft. 6 in. in length and 24 ft. in height from the waterline to the top of the hull. They are of all-metal construction, and the wing framework and the massive hull are covered by metal sheeting. There are two decks in the hull, and the foremost compartment on the upper deck is the "control room." The curved front wall of this room consists chiefly of a large window that provides an exceptionally fine and unobstructed view in all directions except directly behind and straight down. The control room has the most modern types of navigational instruments, and includes a Sperry Automatic Pilot and blind-flying equipment.

The four powerful engines mounted in streamlined nacelles faired into the leading edge of the wings are of the Bristol "Pegasus X" type. Each engine develops 900 h.p., with a total weight of little more than 1 lb. per horse-power. Together they give the flying boat a top speed of 200 m.p.h. at 5,500 ft. and a cruising speed of about 160 m.p.h.

The *"Caledonia"* was commanded by Captain Wilcockson, who has been with Imperial Airways since the company was formed in 1924 and has flown over 1,000,000 miles. With him were Mr. Charles Bowes, the First Officer, who is a first-class navigator, Mr. T. E. Hobbs, Wireless Operator, and Mr. T. Vallette, an aircraft wireless expert of the Marconi Company. Shortly before the flight began the four were received by Mr. De Valera, President of the Irish Free State, on board a launch in the harbour.

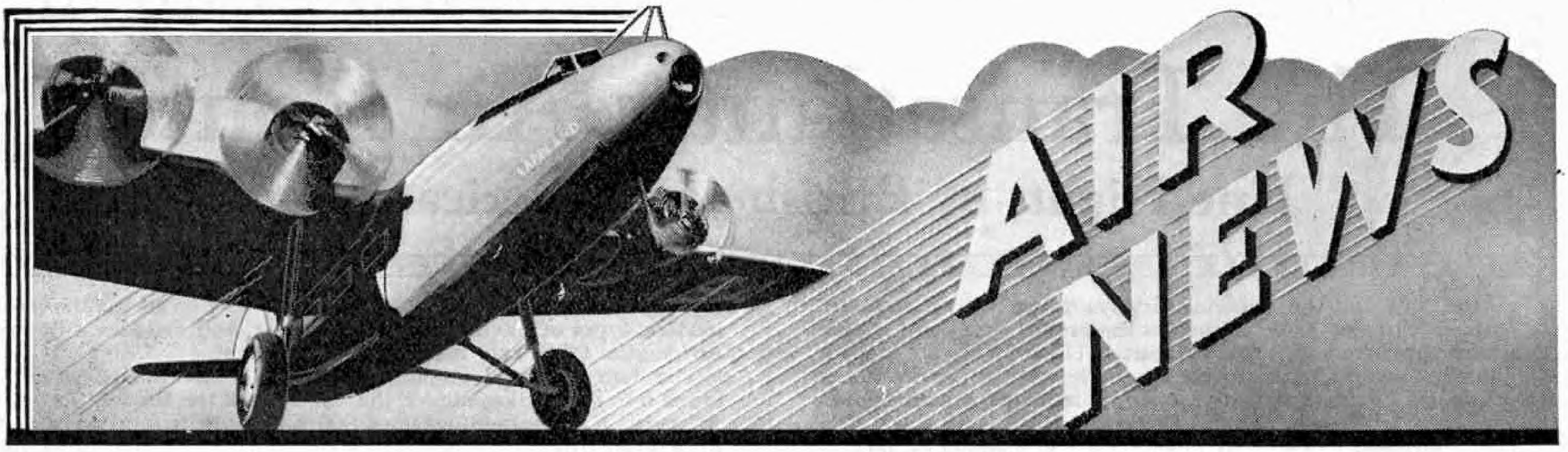
The regular Atlantic service will be operated jointly by Imperial Airways Ltd. and Pan-American Airways Corporation, and the two companies are co-operating in the preliminary research and test flights. At the same time that the *"Caledonia"* made her westward flight, one of the huge Sikorsky S.42-B flying boats of Pan-American Airways was speeding eastward to Foynes. This machine also was equipped with special petrol tanks. It was piloted by Captain H. Gray, and the other six members of the crew consisted of First Officer; Second Officer who acted as navigator; engineer; assistant engineer; radio operator, and clerk. The flying boat took off from Botwood at 10.10 p.m. (British summer time), two hours after the *"Caledonia"* had set off from Foynes, and favoured by the westerly winds that hindered the British machine, made a fast and uneventful crossing. Foynes was reached in the forenoon of 6th July, and to the cheers of a great crowd of spectators the Clipper made a good landing, after having been in the air 12 hr. 34 min. The average speed for the flight was 156 m.p.h.



The crew of the "Caledonia" on the Atlantic flight. Reading from left to right, they are: Wireless Operator T. E. Hobbs; Mr. T. Vallette, an aircraft wireless expert of the Marconi Company; First Officer C. H. Bowes, and the Commander, Capt. A. S. Wilcockson.

The flights were triumphs of organisation and weather forecasting. The aircraft followed courses that had been carefully mapped out for them, and the weather conditions they experienced bore out with remarkable accuracy the conditions they were given to expect. The head winds met with by the *"Caledonia,"* the time and places where rain was encountered, and the time and locality of fog experienced by the American machine, all confirmed the forecasts prepared for the flights by the meteorologists.

The return flights were begun on 15th July and were equally successful. The *"Caledonia"* crossed from west to east, with the prevailing winds behind her, in the remarkable short time of 12 hours 7 minutes, a new record for the North Atlantic, and the Pan-American Clipper arrived at Botwood 16 hours 24 minutes after leaving Foynes.



World Altitude Record Regained for Britain

The world altitude record was regained for Great Britain on 30th June last when Flight Lieut. M. J. Adam, of the Experimental Section of the Royal Aircraft Factory, Farnborough, flew to a height of 53,937 ft. or just over 10 miles. This was 2,575 ft. higher than the record achieved by the Italian pilot Lieut. Col. Mario Pezzi the previous month, and 3,993 ft. more than the height reached by Squadron Leader F. R. D. Swain in October 1936.

The aeroplane in which the record flight was made was the Bristol 138a single-engined monoplane employed last year by Squadron Leader Swain. Certain modifications have since been made, and it is now designed for flights at heights of 50,000 ft. and over. An illustrated description of the machine appeared in the "*M.M.*" of November 1936.

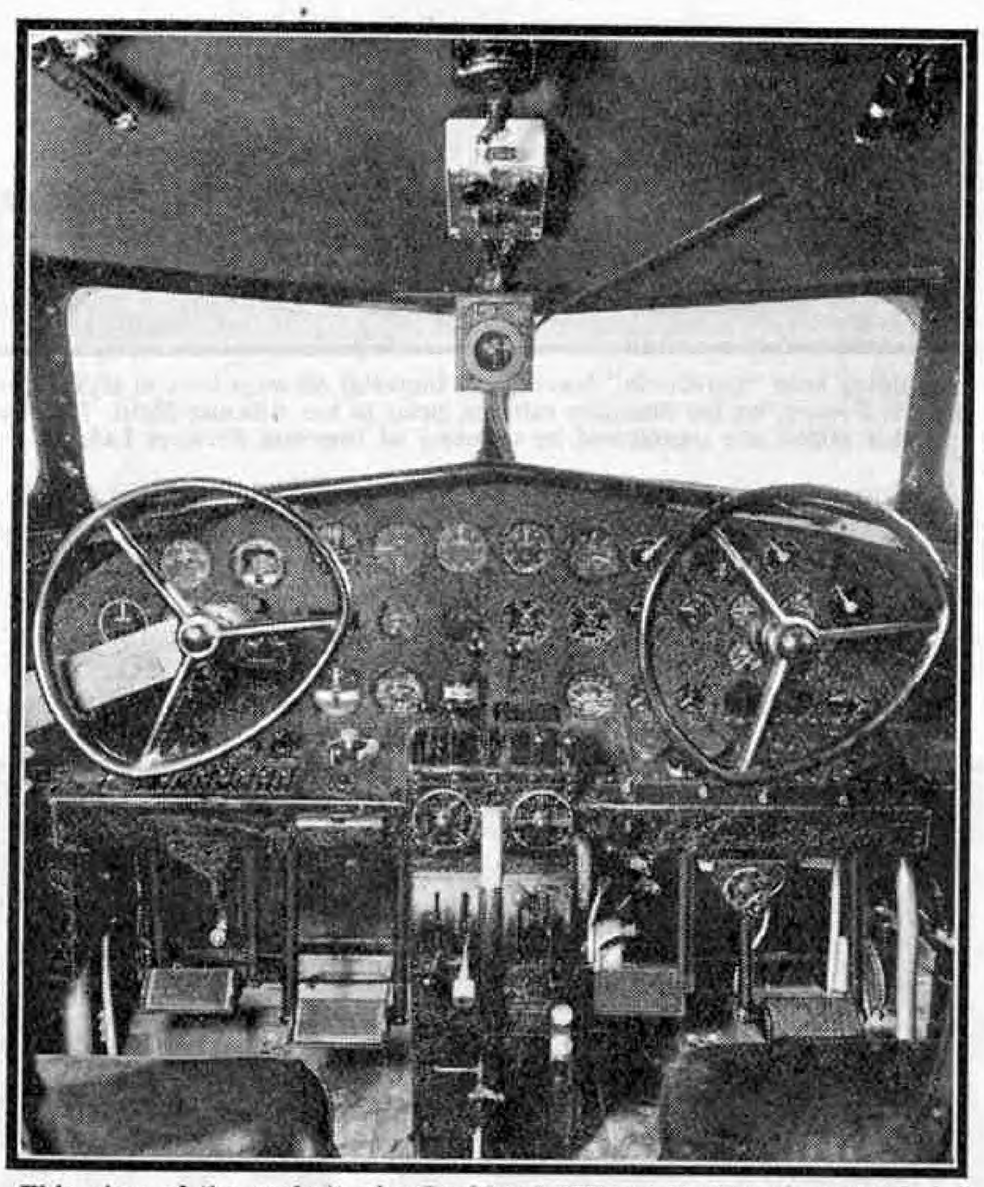
Flight Lieut. Adam's story of his great flight was a thrilling one. He took off from the R.A.F. aerodrome at Farnborough at 5.40 a.m., and shortly afterward the sky clouded over and he had to fly blind. At a height of 35,000 ft. he saw the ground only through occasional gaps, and the last place he was able to identify was Rochester. When he reached 50,000 ft. he believed he was flying somewhere between Bristol and Oxford, but had not then seen land for half an hour. There was slight frosting inside the cabin at a height of 38,000 ft., and the last 4,000 ft. of the climb took 35 minutes. The record height was reached 1 hr. 35 min. after taking off.

When Flight Lieut. Adam was flying near his greatest height he heard a loud report above him. Owing to the shape of his helmet he could not see what caused this, and he had to endure the terrifying suspense until at last he managed to wriggle into a position from which he could peer upward. Then he saw that the roof of the cockpit had cracked, probably due to the structure contracting owing to the intense cold at that great height.

The machine was now no longer climbing and the altimeter reading showed that the record had been beaten by a substantial margin. The pilot therefore turned the nose of his aeroplane downward, and glided all the way back to Farnborough, where he made a safe landing after being in the air 2 hr. 15 min.

Flight Lieut. Adam was clad in a special sealed pressure suit similar to the one used by Squadron Leader Swain, and he used the special breathing apparatus throughout the flight. The sealed instruments for recording atmospheric pressure and temperature were carried in the wings of the aeroplane, and on its return they were examined by the National Physical Laboratory. The temperature at the record height was 48.9 deg. C. below freezing point.

This great achievement is not the end of British flights at great heights, and the Bristol 138a experimental high altitude aeroplane will continue to be employed upon work of this character.



This view of the cockpit of a Lockheed "Electra" gives a good idea of the large number of controls and instruments to which the pilot of a modern air liner must give attention during flight. A description of this interesting American monoplane appears on page 458. Photograph by courtesy of British Airways Ltd.

Illuminated Buoys for Singapore Harbour

It has been decided to define the seaplane channel near Singapore Harbour by illuminated buoys moored at intervals of 100 yds., and an order for the buoys has been placed with the General Electric Co. Ltd. by the Government of Singapore. The buoys will be of concrete, and each will have a floodlit cone. They will be connected together with a high-voltage cable leading, in each buoy, to a transformer that will step down the current for the 6.6-volt lamp in the cone. The transformer will be fitted in a watertight cast-iron base in the buoy.

Liverpool's Magnificent Airport

Liverpool will own one of the finest commercial airports in the country when the important constructional work in hand at Speke Airport is completed. Good progress is being made, and the control tower, which forms the first part of the main building, was recently officially opened by Lord Derby. The tower is 90 ft. in height, and its seven floors accommodate the control room and lookout turret, radio and meteorological service room, record room and telephone exchange; and an electric lift provides rapid communication with any of them.

The control room is octagonal in shape, with large windows on all sides, and as it is 70 ft. above ground level the control officer has a clear view in all directions, without leaving his seat. The apparatus in this room is of an intricate character, but is easily operated. There are indicator lights to show whether the airport equipment switched on is in operation, and immediate warning is given of the partial failure of any part of it. Electrical de-icing and cleaning devices keep the windows clear in bad weather, and messages can be signalled to all aeroplanes in the vicinity of the airport by means of a special two-colour signalling device giving red or green flashes in Morse. The system of radio directional-finding is of the latest type, and the radio beacon guides arriving aircraft safely to the airport landing area even in the densest fog.

Lord Derby also officially opened the new hangar. It is 407 ft. in length, 212 ft. in width and 65 ft. in height, and is believed to be the largest in Europe. The massive folding doors of the hangar are 36 ft. in height, weigh 50 tons, and are opened automatically.

Qantas Pilots for Imperial Airways "School"

Three pilots of Qantas Empire Airways, the company operating the Singapore-Brisbane section of the England-Australia air route, have been sent to England for training at the Imperial Airways "finishing school." These men have been engaged in piloting the fine D.H. "Diana" air liners used by that company, and their further training is necessary to qualify them to take over the piloting of Empire flying boats next year, when these will replace the landplanes now in use. The pilots crossed the Mediterranean in one of the new machines, and gained a high opinion of it.

South Africa Airways Buy Junkers Aircraft

The Junkers Ju 52 air liners employed on the services of South Africa Airways have proved so efficient that Junkers aircraft have been chosen for the additions now being made to the S.A.A. fleet. The new liners are Ju 86s, and the upper illustration on this page shows the first two of them carrying out a test flight near Dessau. They bear their South African registration letters, and are fitted with Rolls-Royce "Kestrel" engines instead of the B.M.W. 132s that are the standard equipment.

Shortly after the test flights the two aircraft were delivered by air to South Africa Airways. They flew from Dessau to Rome, across the Mediterranean to Tripoli, and by way of Cairo, Khartoum, Kisumu and Bulawayo to Johannesburg.

The Ju 86 seats 10 passengers, and is one of the most graceful of modern air liners. It has proved efficient in greatly varied climatic conditions.



Two Junkers Ju 86 air liners, with South African registration letters, making a test flight near Dessau, prior to being flown to South Africa. They are the first of a fleet of machines of this type for South Africa Airways. Photograph by courtesy of Junkers Flugzeug-und-Motorenwerke A.G., Dessau.

Mersey Air Ferry

A regular air ferry service across the River Mersey has been started by a new company called Utility Airways. The service operates between Hooton Aerodrome on the Cheshire side of the river and Speke Airport on the Liverpool side, and four flights daily are made in each direction, a Monospar ST.12 being used. The flight takes only about five minutes, and is a great saving in time to business people, as the journey by surface transport occupies practically an hour. At Speke the ferry connects with the internal air lines operating from that airport.

The Cross Mersey Ferry, as it is called, is the third service of its kind to be established in this country. The other two are the air ferry across the Bristol Channel, and the Isle of Wight ferry service.

Russia–U.S.A. Flight

Three Soviet airmen recently flew non-stop from Moscow to a point about 10 miles from Portland, Oregon. Their route crossed the North Pole and the distance covered was about 5,500 miles. The flight took 63 hr. 17 min. and averaged 82 m.p.h., and about 1,500 miles of it were over the frozen Arctic Ocean.

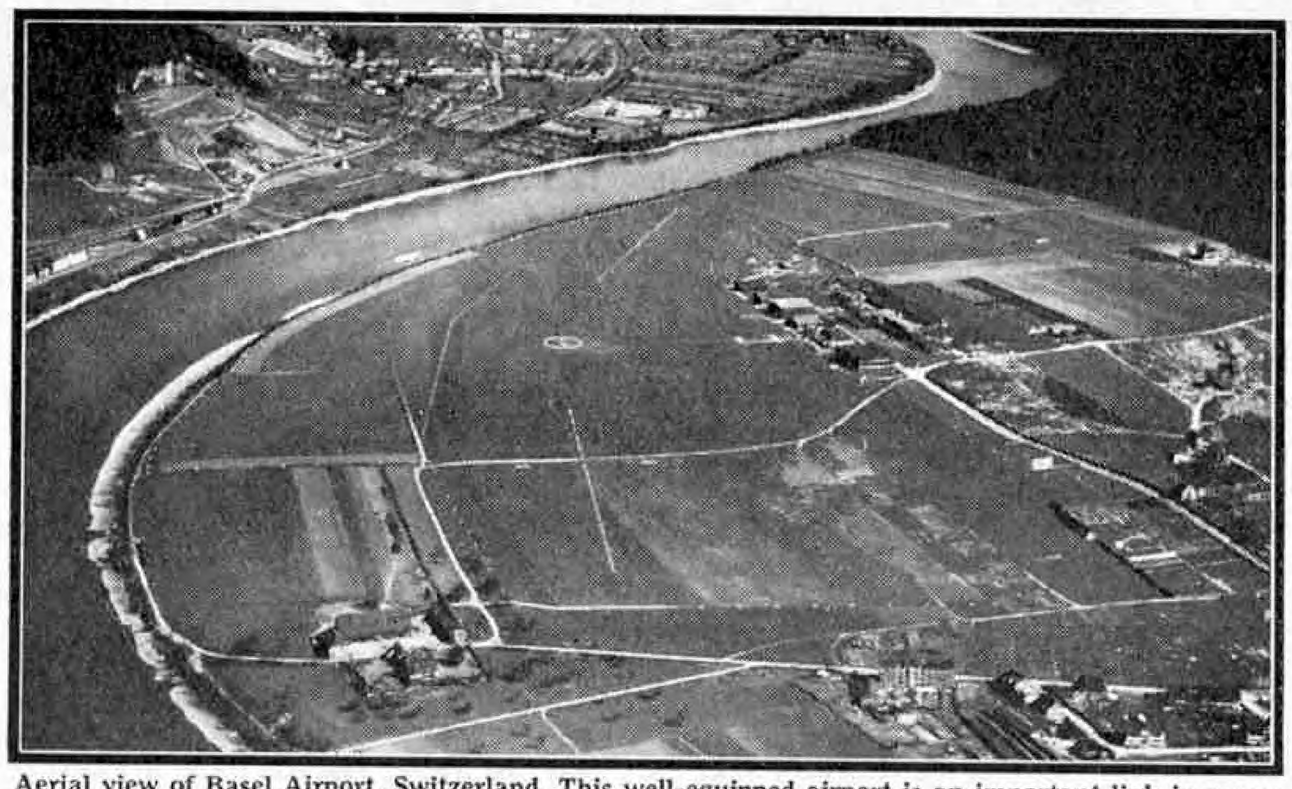
The route followed gave the airmen the distinction of being the first to link Soviet Russia with the United States by air, by way of the North Pole. They flew an A.N.T.26 monoplane fitted with a Russian engine of 960 h.p. The aeroplane was provided with special floats in the wings and fuselage, so that it could remain afloat for a long time in the event of a descent on the sea.

Performance of New R.A.F. Bombers

The Air Ministry have now disclosed details of the performance of five of the new types of bombers that are being supplied to the R.A.F. The types are the Armstrong Whitworth "Whitley" and Handley Page "Harrow" heavy bombers, the Fairey "Battle" and Bristol "Blenheim" medium bombers, and the Vickers "Wellesley" general purpose and long-range bomber.

The fastest of these five bombers is the "Blenheim," with a top speed of 279 m.p.h. at 14,000 ft., and the second fastest is the "Battle," with a top speed of 257 m.p.h. at 15,000 ft. The service ceiling of the "Blenheim" is 30,000 ft., while that of the "Battle" and "Wellesley" is 26,000 ft. The "Harrow" has a service ceiling of 19,200 ft. and the corresponding figure for the "Whitley" is 19,000 ft. All these bombers have a range of at least 1,000 miles, and the "Whitley" can fly 1,500 miles non-stop at cruising speed.

An interesting point is that the new bombers are all monoplanes. The "Whitley" and the "Harrow" are high wing machines, the "Blenheim" is of the mid-wing type, and the "Battle" and the "Wellesley" are low wing aircraft.



Aerial view of Basel Airport, Switzerland. This well-equipped airport is an important link in many European air services. Photograph by courtesy of Swissair.

Empire Air Mail Scheme Progress

Letter-mails are now carried, without special fee, over the Empire air routes of Imperial Airways. The new service began on 29th June last on the company's Anglo-Egyptian Sudan, East and South Africa route, when the first load of air mails to be flown at the flat rate of 1½d. per ½-oz. for letters and 1d. for postcards left Southampton Water in the flying boat *"Centurion."* The mails totalled over 110,000 letters, and included a special letter of greeting from the King to the Governor-General of South Africa.

The service was inaugurated by a brief, interesting ceremony on board the motor vessel *"Medina"* lying alongside the *"Centurion."* During this ceremony Lord Swinton, the Secretary of State for Air, handed the King's letter to Major G. C. Tryon, the Postmaster General, who stamped it and placed it in a special mail bag which was then sealed and handed to the commander of the flying boat. The other mails were already on board, and the *"Centurion"* promptly took off on the first stage of her 7,250-mile flight to Durban.

There are now three Empire air mail services to South Africa each week, one terminating at Kisumu, in Central Africa, and the other two continuing to Durban; and there are two services from Durban to Southampton. Empire flying boats over this route have reduced the journey time from 8 to 6 days, and when night flying is introduced the time will be further reduced to 4½ days.

World's Largest Aero Tyres

The largest aeroplane tyres ever made were fitted recently to the first of the Armstrong Whitworth "E" class air liners under construction for Imperial Airways. The tyres are 6 ft. 6 in. in overall diameter and 2 ft. 3 in. in thickness, and only two of them are required for an aeroplane weighing 22 tons. The weight of air contained in each tyre, at 40 lb. per sq. in., is about 10 lb.

The tyres were produced at Fort Dunlop, and enormous stresses were involved in their manufacture. An internal pressure of 250 lb. per sq. in. was required to permit proper moulding to the airbag, which made it necessary for the mould to withstand a total pressure of about 390 tons.

Gloster "Gladiators" for Sweden

The equipment of the Swedish Air Force is to be increased by the addition of several Gloster "Gladiator" single-seater fighters fitted with Bristol "Mercury" engines. This Force already includes Hawker bombers and reconnaissance aircraft and D.H. "Tiger Moth" two-seater trainers.

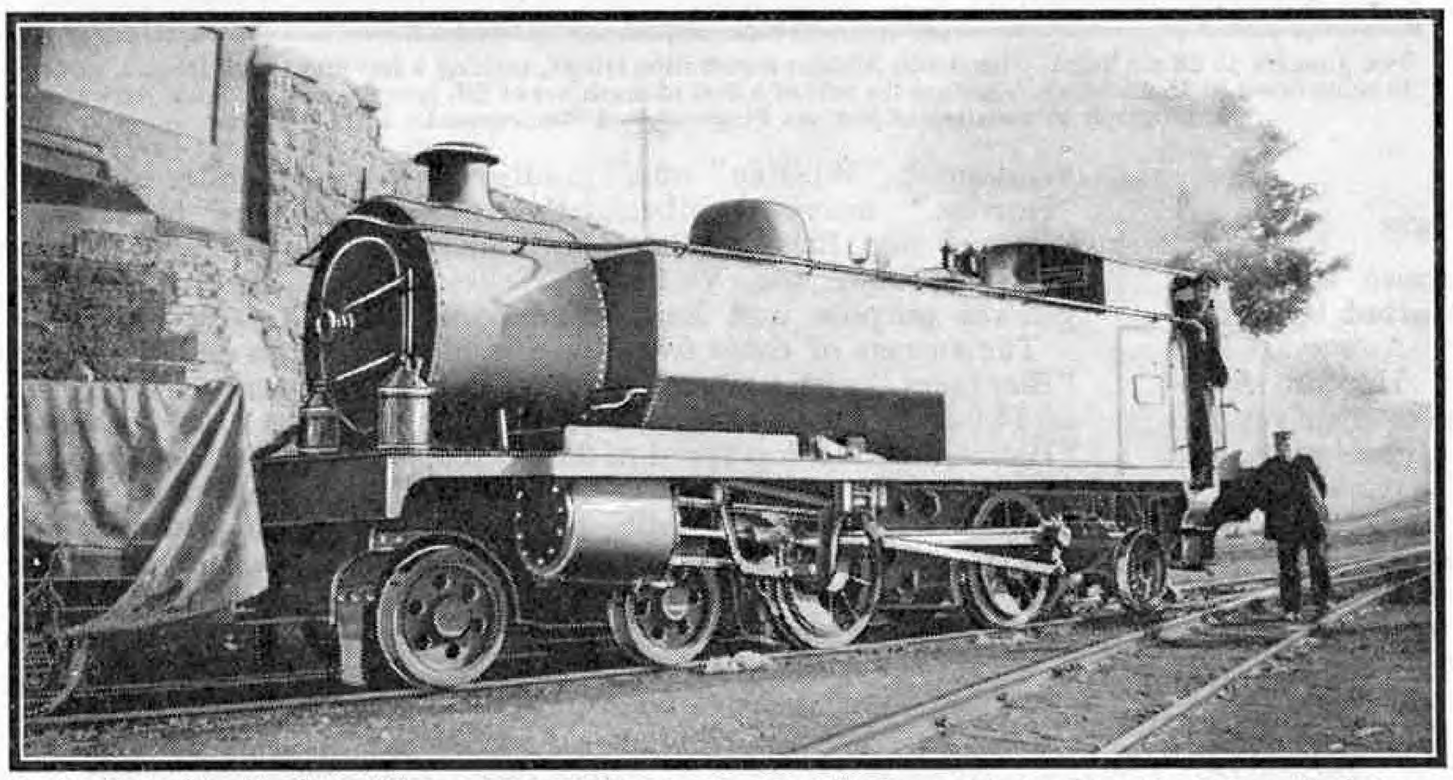
The Ballycastle Railway

An Interesting Irish Narrow Gauge Line

By a Railway Engineer

THERE is something very attractive about any narrow gauge railway system. While one may admire, and perhaps be a little awed by a giant engine of standard gauge, a smaller edition is in many ways still more interesting to a railway enthusiast, who can crawl all round, and perhaps even drive the miniature. It matters little whether the particular line uses scale models of full-sized engines, as on the Ravenglass and Eskdale Railway, or genuine narrow-gauge locomotives built strictly for utility and without any particular eye to their publicity value. Scale models are almost entirely confined to 15-inch gauge lines, but there is within the British Isles a considerable number of light railways having gauges in the neighbourhood of three feet, on which are to be found some very interesting locomotive types.

The west of Ireland was at one time served by quite a number of such lines. A cheap type of construction can be used that is naturally attractive to the promoters of a railway planned to serve a thinly populated region where there is little chance of any heavy traffic; but in recent years most of these lines have suffered severely from road competition, train services have been reduced to a mere skeleton of their former selves, and the majority of the passenger workings have been operated by Diesel railcars. The Northern Counties Committee section of the L.M.S. however has, in the Ballycastle branch, one narrow-gauge section over which a full passenger service is still worked entirely by steam locomotives, and a more fascinating little railway it would be hard to imagine.



The Northern Counties Committee narrow gauge engine No. 114. This formerly belonged to the Ballycastle Railway, but is now working on the Larne line.

This branch connects at Ballymoney with the broad-gauge main line from Belfast to Portrush and Londonderry; like that of the other N.C.C. non-standard routes the gauge is 3 ft. Although the branch is only 16¼ miles long it is an important link, and provides the quickest service to one of the most charming resorts on the Antrim coast. For a long time it was an absolutely independent concern. Long after the neighbouring narrow gauge lines, the Ballymena and Larne, and the Ballymena, Cushendall and Red Bay, had been absorbed in the Belfast and Northern Counties Railway, the Ballycastle line stood out alone, and it was nearly two years after the English Midland Railway, and with it of course the N.C.C., had become part of the L.M.S., that the separate existence of the company came to an end.

Until that time traffic had been operated almost entirely by two 4–4–2 tank engines built by Kitson and Co. in 1908. They are portly looking engines of characteristic Kitson appearance, but after the amalgamation they were transferred to Ballymena to work goods trains on the Larne line. Their place on the Ballycastle Railway was at first taken by some of the 0–6–0 tank locomotives previously used on the Larne line; by their very size and quaintness these latter were irresistibly fascinating little engines, but all of them are now scrapped. When the passenger service was withdrawn on the Larne and Cushendall branches considerably fewer narrow gauge engines were needed for the whole system, and it was naturally the oldest and smallest that went to the wall.

The Ballycastle line is now being worked by two of the Class S 2–4–2 compounds, which are among the most distinctive and original tank locomotive designs that have ever been put on the road. In the "*M.M.*" for September 1936 I described the remarkable two-cylinder compounds designed by Mr. Bowman Malcolm for the broad gauge lines of the N.C.C.; in applying the Worsdell-von Borries system to the narrow gauge both cylinders had to be placed outside owing to the very restricted space between the frames. There was nothing unusual in the mere fact of the cylinders being outside, for all the other narrow gauge engines were the same in this respect; what makes the compounds look so queer when seen from the front end is that the cylinders are of different sizes. The high-pressure cylinder is 14¾ in. diameter, and the low-pressure 21 in. diameter, both having a stroke of 20 in.

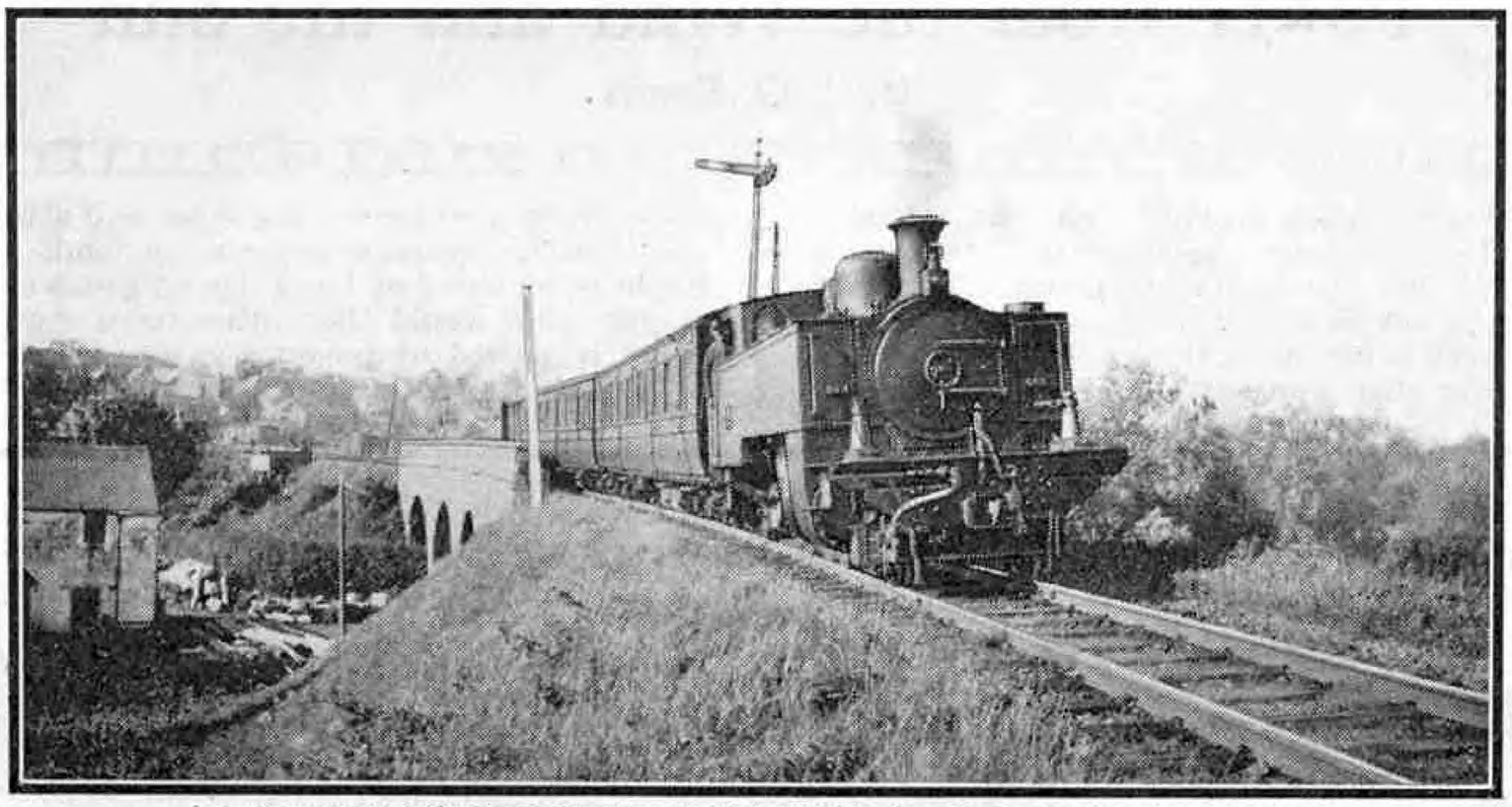
The engines were originally designed to work on the Ballymena and Larne line, over which a boat express used to be run in connection with the Stranraer steamer. This train was timed quite fast for a narrow gauge line, and the stiff ascent to Ballynashee summit involved some strenuous locomotive work. In view of this duty they were provided with side tanks of large capacity. The first two of these engines were built by Beyer Peacock in 1892; two further engines were added to the stock in 1908-9, and it is these two that are now working on the Ballycastle line, namely Nos. 101 and 102. The last two of the type were constructed as recently as 1919-20. One of the 1892 engines, No. 110, has recently been rebuilt with a Belpaire boiler having 200 lb. per sq. in. pressures, and this alteration and the consequent increase in weight have necessitated its conversion to the 2–4–4 wheel arrangement. All these narrow gauge engines are painted Midland red, and look very fine. The two original 2–4–2 engines were painted in the bright myrtle-green livery of the Belfast and Northern Counties Railway. They were lined out in white and red in a manner very similar to that of the former L.N.W.R., and the likeness was heightened by the cast number plates, having raised figures on a bright orange ground. After the Midland took over, all the Northern Counties engines were painted a pleasing shade of olive-grey, known officially as "invisible green."

Coming now to the Ballycastle line itself, the track layout at Ballymoney is quite complicated. Narrow gauge passenger trains are accommodated alongside the up main line platform, but there is an extensive broad gauge goods yard on the up side for dealing with the large cattle traffic. Not only this, but by running broad and narrow gauge goods lines alongside each other the transhipment of merchandise for the Ballycastle branch is made much easier. The presence of this big goods yard however means that broad gauge shunting, and goods movements to and from the main line, are carried out right across the narrow gauge tracks; accordingly the points and signals of both gauges are all interlocked with one another just as though they were part of the same system. The narrow gauge signals have miniature arms carried much lower than the usual height. Once clear of Ballymoney yard signalling presents no difficulties, for the branch is worked on the "one engine in steam" principle. The two locomotives shedded at Ballycastle are used on alternate days, one being sufficient to work the whole day's service. The branch possesses only two engine crews; whichever locomotive is doing the day's work is remanned in the early afternoon, the two pairs of men working "early" and "late" turn on alternate weeks.

Once a traveller alights from the main line train at Ballymoney and goes over to the branch platform, all the traditional bustle and efficiency of the N.C.C. system is gone in a flash, or so it seems. Here is the perfect Irish joke of a railway. Passengers join in lively badinage with enginemen and guard, the fireman is solemnly recoaling the engine from wicker baskets, and a stranger feels as

though he has dropped in at some intimate family party rather than a serious transportation concern. But this homely happy-go-lucky sort of atmosphere reflects anything but the true character of the line, which despite outward appearances is just as efficient and reliable as any other part of the N.C.C., which, renowned as it is for strict punctuality. is saying a great deal.

The somewhat primitive method of refuelling the narrow gauge engines at Ballymoney is of course due to the absence of any form of mechanical coaling appliance. All coal used on the N.C.C. is imported from Scotland, and supplies for the Ballycastle line are sent down from Belfast and transferred at Ballymoney into small baskets so as to be easily handled by the local firemen. The engines are watered from a picturesquely old-fashioned tank built up on brick pillars on the extreme far side of Ballymoney goods yard, and in consequence on each trip locomotives have to make quite a number of reversing movements in order to replenish their tanks.



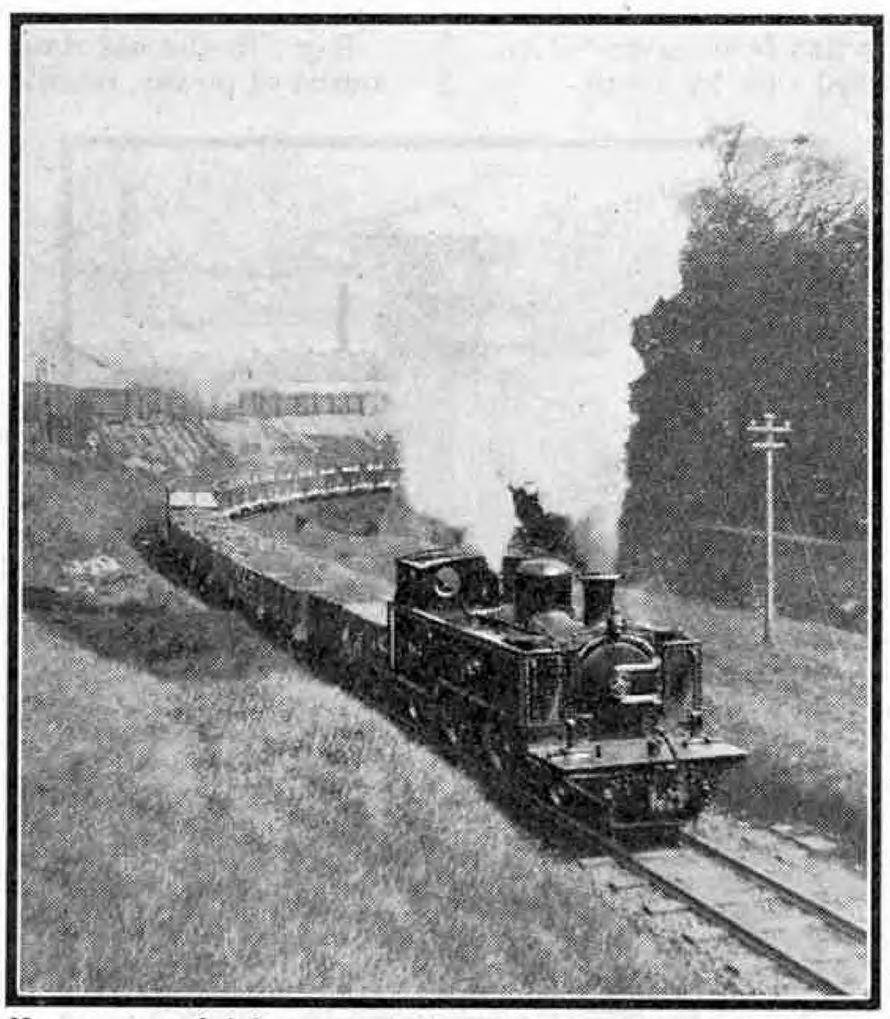
A narrow gauge train for Ballymoney leaving Ballycastle, with engine No. 101 at its head.

To a stranger preparing, according to his nature, either to enjoy or bemoan the joke, the carriage interiors provide the first surprise, for they are well upholstered, scrupulously clean, and adorned with attractive pictures. Externally they are a narrow gauge edition of the Midland main line stock in use just before grouping took place, with high elliptical roofs and seating three a side. They ride very smoothly, and to the accompaniment of that characteristic singing rhythm that one invariably notices when running on flat-bottomed rails. The other incidental noise of travel, the beat of the engine, savours much less of a narrow gauge railway owing to there being with the compounds only two exhausts for every revolution of the driving wheels. The small diameter of the wheels makes the exhaust period almost the same as that of a 6 ft. 9 in. standard gauge two-cylinder simple engine.

Like the 2–4–0 engines of which I wrote in the "*M.M.*" for September 1936, these narrow gauge tank locomotives are started up practically full compound. Live steam is admitted to both cylinders for the first stroke of the pistons, but immediately the high-pressure cylinder exhausts an automatic changeover valve operates and compound working begins. Steam distribution in both the high and low-pressure cylinders is effected by means of separate sets of Walschaerts valve gear, but both sets of gear are controlled by one reversing lever in the cab. The cabs, by the way, are only just big enough to accommodate the driver and fireman, yet strangely enough when I last travelled over the line our fireman was one of the most enormous individuals I have ever seen on a locomotive; anyone attempting to ride on the footplate would most assuredly have had to hang on to the step outside for most of the trip! On the Ballycastle line these fine little engines are not called upon for any strenuous work, and in this respect the railway may well be classed with another in the West of Ireland, which recently became a butt for Mr. Lynn Doyle's keen humour. In describing a journey on which a train was soundly beaten by an aged and ramshackle motor car running on a parallel road, he suggests that a Society for the Prevention of Cruelty to Engines would never have obtained a conviction against that particular line! That is not to say that the N.C.C. 2–4–2 tanks cannot run when occasion demands. Indeed, in the days of the Larne boat expresses really fine work was needed to cover the 25 miles from Ballymena in 60 minutes, climbing en route to Ballynashee summit, 650 ft. above sea level.

After leaving Ballymoney the Ballycastle branch runs through fairly level country at first, the landscape being a wide expanse of peat bogs, dotted with small single-storied cottages, and rising southward towards the Antrim highlands. Shortly before reaching Dervock, the first station, the River Bush is crossed, and then the line swings eastward through Stranocum, Gracehill, and Armoy, climbing steadily all the way until it comes almost beneath the shadow of Knocklayd, the northernmost of the Antrim mountains. These stations are classed officially as "halts," but all of them possess goods sidings, and wagons are often picked up or dropped by passenger trains. No goods trains are regularly scheduled, and the majority of the passenger trains are booked to convey goods traffic if required. The majority of the trains consist of two bogie passenger coaches and not more than one or two four-wheeled goods wagons. These capable little engines are, however, permitted to take much heavier loads when occasion demands, and on the heaviest gradient, from Ballycastle up to Capecastle, trains may be made up to seven bogie coaches, or 14 wagons and a brake van.

Beyond Armoy the route becomes very picturesque. The broad green flanks of Knocklayd sweep upward on the right, the track winds its way between high hedgerows, and the lineside is deep with waving grass. Often the journey is enlivened by the antics of a goat tethered to the boundary fence. The summit level is reached at Capecastle, after which the line descends steeply to the sea. This is a delightful stretch, with rolling hills on both sides of the line, and concluding with a pleasing glimpse of the bay as the train swings round into Ballycastle. The station is however in the upper part of the town, and this brief vista from the carriage window is but the merest fraction of the exquisite scene to be enjoyed from the shore, a scene that includes the limestone cliffs of Rathlin Island, the majestic bluff of Fair Head, and the long broken ridge of Kintyre, Scotland's nearest point.



Narrow gauge 2-4-2 compound side tank engine No. 111. Photograph by courtesy of the L.M.S.

Ballycastle station is quite a primitive affair. A single platform, curiously old-fashioned buildings suggesting the earliest days of railways, and a quaint engine-shed just big enough to house two of the compound tank locomotives, combine to produce an out-of-the-world atmosphere quite unlike the rest of the N.C.C. system. As the line is quite isolated from the other N.C.C. narrow gauge branches, its two engines have to be maintained entirely from the Ballycastle running shed. When heavy repairs are needed the locomotives are transported bodily to Belfast shops. In this connection it is of interest to recall that some of these 2–4–2 tanks were the first new engines to be constructed entirely in the N.C.C. works. Although in recent years several standard gauge engines have been erected in Ireland, the components have been shipped over from the Derby works of the L.M.S. In the case of the 1908-9, and 1919-20 batches of compound tanks the whole of the work was done in Belfast. The standard timing of all trains is 50 minutes for the 16¼-mile run from Ballymoney to Ballycastle, which allows for stops at all stations. During the summer, however, there is one non-stop train, which makes the run in 40 minutes. This runs in connection with "*The Golfers' Express*," to Portrush. By this service Ballycastle is reached in less than two hours from Belfast.

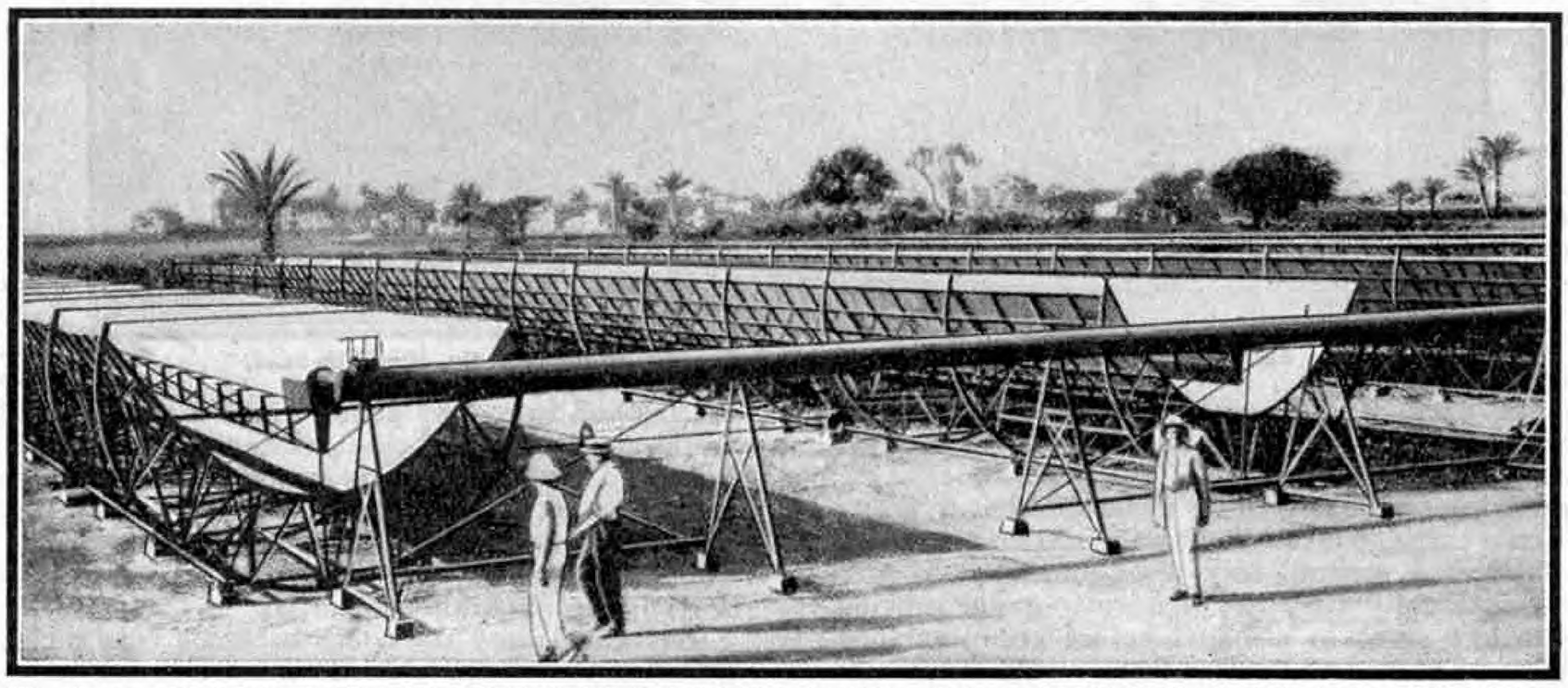
Inventions of the Future

Power from the Wind and the Sun

By I. O. Evans

THERE is one important respect in which our civilisation is different from that of our ancestors, and this is in the use of energy. The people of old had few sources of power. They used windmills and waterwheels, but on a very small scale, and only for driving simple machines such as hammers, that could be attached to them. They had no means at all of transmitting power from place to place, and the greater part of their work had to be carried out by animal or human toil.

To-day the labour of beast and man plays a comparatively small part in our work, and for almost all our more important tasks we make use of machines. In place of the galley with its lines of toiling rowers we have the steamship, and the horse-driven coach has given way to the locomotive and the petrol-driven car. Mechanical harvesters reap and thresh the corn, steam-navvies dig into the ground; and we are continually reading that a new machine has been invented to perform some difficult task previously carried out by hand.



The Shuman-Boys solar heater at Meadi, near Cairo, Egypt. The parabolic mirrors reflected the Sun's rays on long thin tubes or boilers, and the power output of the plant was about 55 h.p.

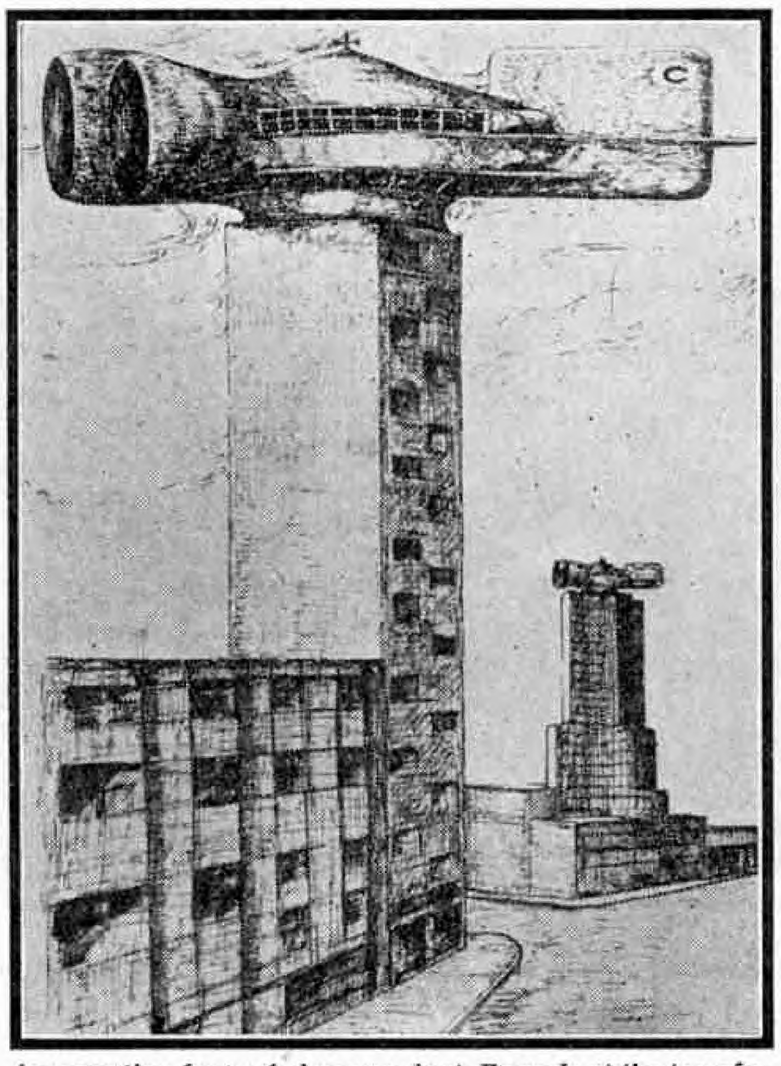
To drive these machines we have one great source of power, the fuel we derive from the earth. Apart from a few machines worked by river or by wind, we drive them by burning petrol, oil, or coal. There may be unknown sources of these yet to be discovered, hidden by the tropical forests or buried beneath the Antarctic snows, but supplies are bound to be limited, however great they may be. What is to happen when we have exhausted them? Without fuel or something to replace it, our civilisation would come to a tragic end. Great cities would perish for lack of food if there were no mechanical transport, and if civilisation of any sort were to last it would be an agricultural one depending on human and animal muscle like the civilisations of the past, unable to support a population as great as that of to-day.

This is a very tragic prospect, but fortunately there are other sources of energy to which we could turn. First, we could distil fuel from the rich plant-growths of the tropical forests, a store that replaces itself every year. Very likely these would not meet all our needs, but they might be able to supply whatever engines there may be that have to depend on liquid fuel.

We have already begun to replace fuel as an energy source by the use of electricity generated by rivers and waterfalls. The waters of these drive great water turbines that spin dynamos to supply with electricity the railways and cities of a whole countryside.

Just as the old-fashioned waterwheels have given place to these huge water-turbines, so we may be able to find better means of using the power of the wind than the crude windmills of our ancestors. A vertical cylinder rapidly rotated in a strong wind is pressed powerfully to one side. Such rotor cylinders have been successfully used for driving ships, and attempts are being made to use them for generating power on land. A number of the rotors might be mounted on trucks running on a circular track. The thrust of the wind would then drive them round the track, and they could be geared to dynamos at its centre.

Winds near the ground are inconstant. Those further aloft are much more steady, and plans have been made for immense wind-motors raised far into the air on towering lattice-work masts. A mast 500ft. high would carry a huge funnel with an opening 80 ft. across, turned to face the wind by means of rudder-like vanes. The funnels would concentrate the wind on to turbines, so that even the slightest breeze would have considerable effect, while stronger winds and gales would produce a great power indeed.



A suggestion for a wind power plant. Funnels at the top of a tower 500 ft. high would concentrate the wind on a turbine.

Even in the old days attempts were made to use the tides as a source of power, paddle-wheels being turned by them and made to drive millstones. Nowadays we neglect the tides completely as sources of power, but later we might attempt to make use of them. For example, they could be used to raise and lower huge floating rafts, geared to machinery on the land. They could be harnessed by dams across river estuaries, and made to drive turbines as they flowed in and out. It is calculated that a barrage across the Bay of Fundy, off the coast of North America, would make available energy of 100,000,000 h.p., and plans have already been made for using the tides in this neighbourhood to generate electric power.

There are other ways of getting energy from the sea that would be even more titanic in scale. The waters of the Mediterranean evaporate in the sunshine more rapidly than they are replaced by the rivers that feed it, with the result that there is a steady current flowing through the Straits of Gibraltar. A barrage across the Straits, provided with immense turbines, would give great power, but would interfere with sea traffic. A more ingenious plan is to dig a channel from the Mediterranean to the Quattara Depression, a valley in northern Africa with a floor several hundred feet below sea-level. The water would at once rush in to convert the valley into a lake. Soon, however, it would evaporate in the fierce heat of the tropical Sun, and there would be a steady flow of water down the channel. It would merely be necessary to instal turbines in this to produce a source of power that would never be exhausted.

The heat of the Earth itself also is a possible source of energy, for it comes to the surface in usable form at volcanoes and hot springs. The heat of Mount Etna has already been tapped on a small

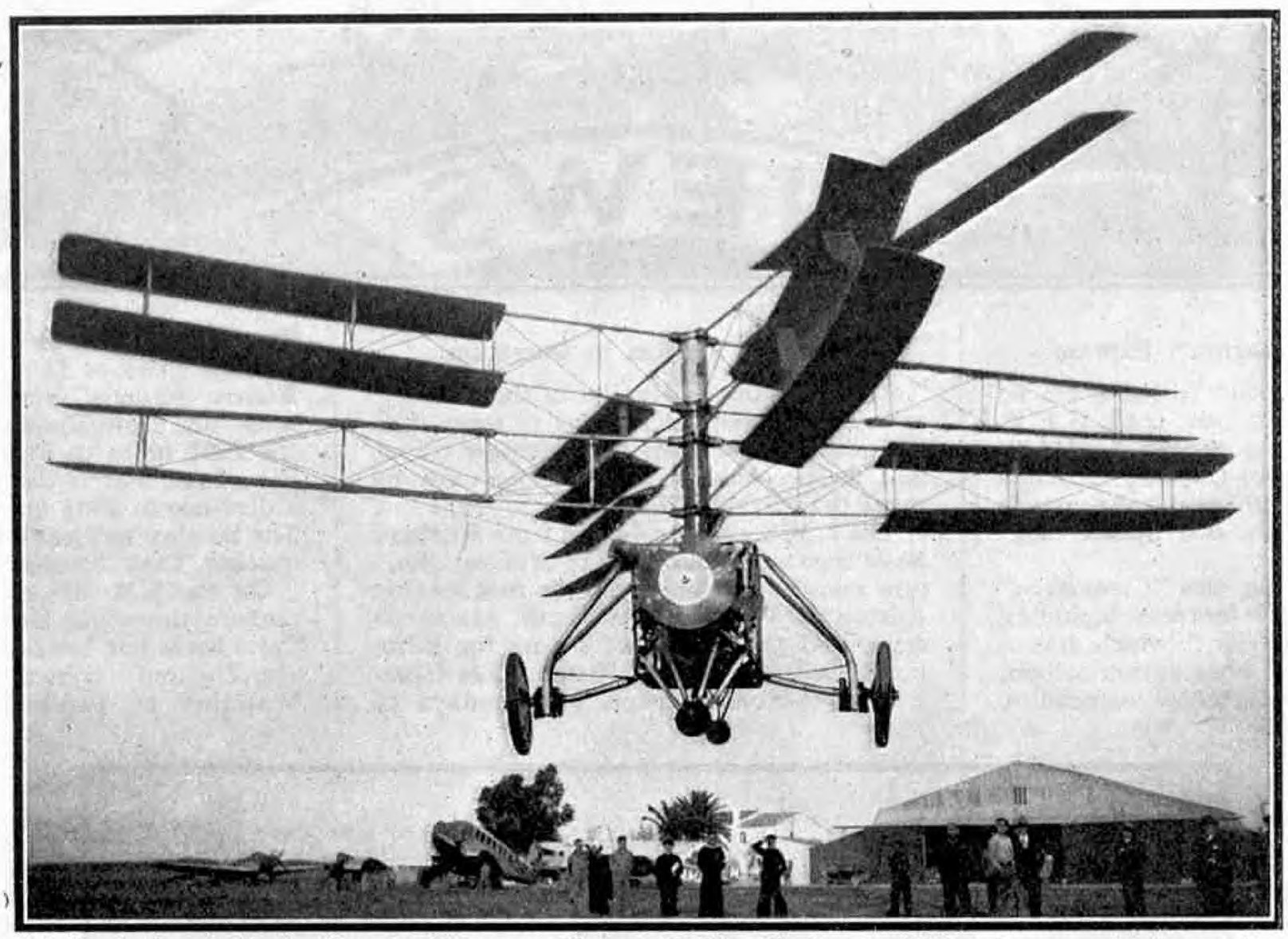
scale, and doubtless the process could be used in other volcanic regions. Volcanoes have done so much damage that it is pleasant to think they can be turned to useful purposes instead.

Even where there are no volcanoes the Earth's heat can still be used. Our coal-mines are unpleasantly warm, and as they are bored deeper their temperature increases. The suggestion has been made that two shafts should be sunk, each to a depth of about two miles, and joined by a horizontal gallery. Cold water pumped down the one shaft would emerge at the other almost at boiling point, ready to give off steam in a low-pressure boiler and so to drive engines and generate electric power.

In this country it sounds almost ironic to talk about using the heat of the sunshine! Other lands, however, are more favoured in this respect than ours, and there solar heat would form a very reliable source of energy. Solar motors have been tried in Arizona, and also in Egypt. In these the heat of the Sun is concentrated by a number of mirrors on to a boiler, raising steam from water pumped into it. In one method the mirrors are ranged on a circular framework, which is gently turned so that they always face the Sun. In the other they are curved to form a trough, concentrating the Sun's rays on tubes through which water flows. This is a method by which we could make use of the most arid desert, converting the Sahara itself into a valuable source of energy for our needs.

Other possible schemes involve the use of the strange "cosmic rays" which fall on the Earth from space, and of the energy of the atoms, the tiny particles of matter of which everything is supposed to consist. A further possibility is the use of photo-electric cells, which convert the Sun's light into electric current, and tiny motors driven by light have been constructed. There is plainly no need to despair of finding sources of energy when our fuel supplies show signs of getting low.

We are accustomed to a countryside that would seem very surprising indeed to our ancestors, with its arterial roads, its railways, its coal mines thrusting their galleries below the ground and its aeroplanes darting overhead. The people of the next century may equally be accustomed to a countryside that would astonish us by the absence of coal mines, steam trains or factory chimneys vomiting clouds of smoke. Lofty wind-towers may rise above it, and the mirrors of sun-motors may gleam here and there, while great barrages with their turbines may close the river mouths. By such methods electricity will be generated, to be transmitted by overhead cables or underground to be used in countless ways. The world will then use as much energy as it needs, but it will be cleaner, healthier and pleasanter than that in which we live.

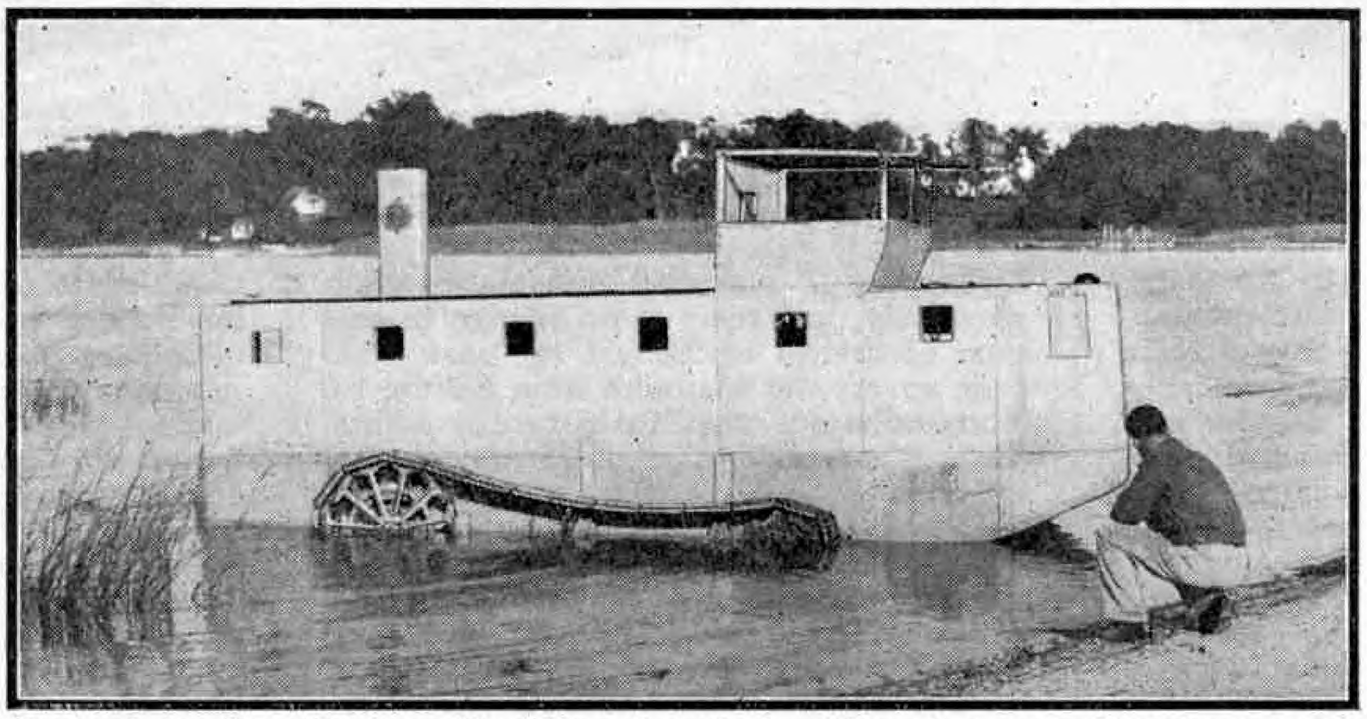


A helicopter invented by the Marquis of Pescara making a trial flight. The two great lifting airscrews rotate in opposite directions. It rises vertically from the ground and flies at an excellent speed.

These new sources of energy will involve modifications of our present methods of transport. For the most part, our engines, cars, ships and aeroplanes carry supplies of fuel with them. We are already beginning to electrify the railways, and this process is likely to continue. For road cars, ships and aeroplanes we may be able to devise improved accumulators that will store sufficient current for long journeys, or we may be able to broadcast energy that moving vehicles on land or on sea or in the air will be able to "receive" and use.

For certain purposes, especially in exploration, craft will be needed that are able to travel equally by land or by sea. There are already floating tanks that can swim across rivers, but these are needlessly clumsy for ordinary peaceful purposes. In the United States experiments are now being made with a "jungle traveller" that will cross broken country on tractor-like caterpillar treads, and will float on water, propelling itself by means of paddles or a screw. This strange-looking craft is shown in the lower illustration on this page. With its "crew" of three, weighing two tons, it travels at 15 m.p.h. on land and 8 m.p.h. on the water, and it should be very useful for exploring the river valleys and jungles of South America.

There are further improvements yet to hope for, in the design of aircraft, apart from the rocket propulsion mentioned recently in the *"M.M."* There is great need of some method of enabling aircraft to rise and sink vertically, and to hover motionless in the air. For this purpose we may at last be able to devise a practical helicopter, lifted by a screw revolving above it. A machine of this kind that has actually flown is shown in the upper illustration on this page. By further research and experiment no doubt the difficulties of helicopter flight will be overcome, and we shall then have a machine that will be able to rise from the flat roof of a house, an ordinary garden, the deck of a ship, or even the body of a huge transatlantic superplane.



The jungle traveller, which is capable of 15 m.p.h. on land, and 8 m.p.h. on water. It carries a crew of three and is intended for use in rough and unexplored country.

Surface transport will not be abandoned, but will undergo many changes. For instance, railway trains will be speedier, and may run suspended from tracks fixed on pylons instead of taking up valuable space on the ground. Mountain ranges will be pierced by tunnels, and there also will be tunnels under the English Channel and other narrow waterways. These tunnels will be available for motor cars. These also will be speedier and simpler than those of to-day, and they will run on arterial roads properly planned to take them, and on which there will be none of the tragic accidents that are now so common.

Similarly we may hope for advances at sea with larger and steadier ships, wireless beams giving visibility through fog and other novel devices to prevent collisions, and surer means of navigation.



L.N.E.R. "*Coronation*" Express

During a test run prior to being placed in regular service on 5th July, the L.N.E.R. "*Coronation*" streamline express, hauled by No. 4489, "*Dominion of Canada,*" reached a maximum speed of 109 m.p.h. An article dealing with this train will appear next month.

The coaches used on the "*Coronation*" express have many new features, including the streamline "Tail Car," which has a "beaver" tail. It is an observation saloon, provided with comfortable armchairs, from which passengers may obtain a view from the rear as the train proceeds. The observation windows are made of a special type of unbreakable glass substitute known as "Perspex," and they are moulded to the curve of the coach.

The five L.N.E.R. locomotives that have been specially built for the new service are finished in Garter blue, with stainless steel lettering and mouldings, and their wheels are painted dark red. They are named after British Dominions, and by permission of the respective governments each displays the appropriate armorial bearings on the cab. No. 4490, "*Empire of India,*" bears an emblem comprising a small shield with the Star of India surmounted by the Imperial Crown. The whistles fitted to No. 4489, "*Dominion of Canada,*" and No. 4488, "*Union of South Africa,*" have been sent specially by the Canadian Pacific Railway and the South African Railways respectively. The remaining locomotives of this class are No. 4491, "*Commonwealth of Australia,*" and No. 4492, "*Dominion of New Zealand.*"

L.M.S. Locomotive News

Class 5P5F 4–6–0s continue to be delivered from the contractors and the latest engine to be put into service is No. 5368.

Among the engines that have been condemned are Nos. 5975, "*Talisman,*" and 5999, "*Vindictive,*" both rebuilt "Claughtons," and Nos. 25680, "*Loadstone,*" 25767, 25779, 25780 and 25833 of the "Prince of Wales" class. Nos. 25287, "*Alchymist,*" and 25302, "*Shamrock,*" also have been scrapped, as has No. 17804, the last of the ex-Caledonian Class 3 2–6–0s.

Summer Services in Operation

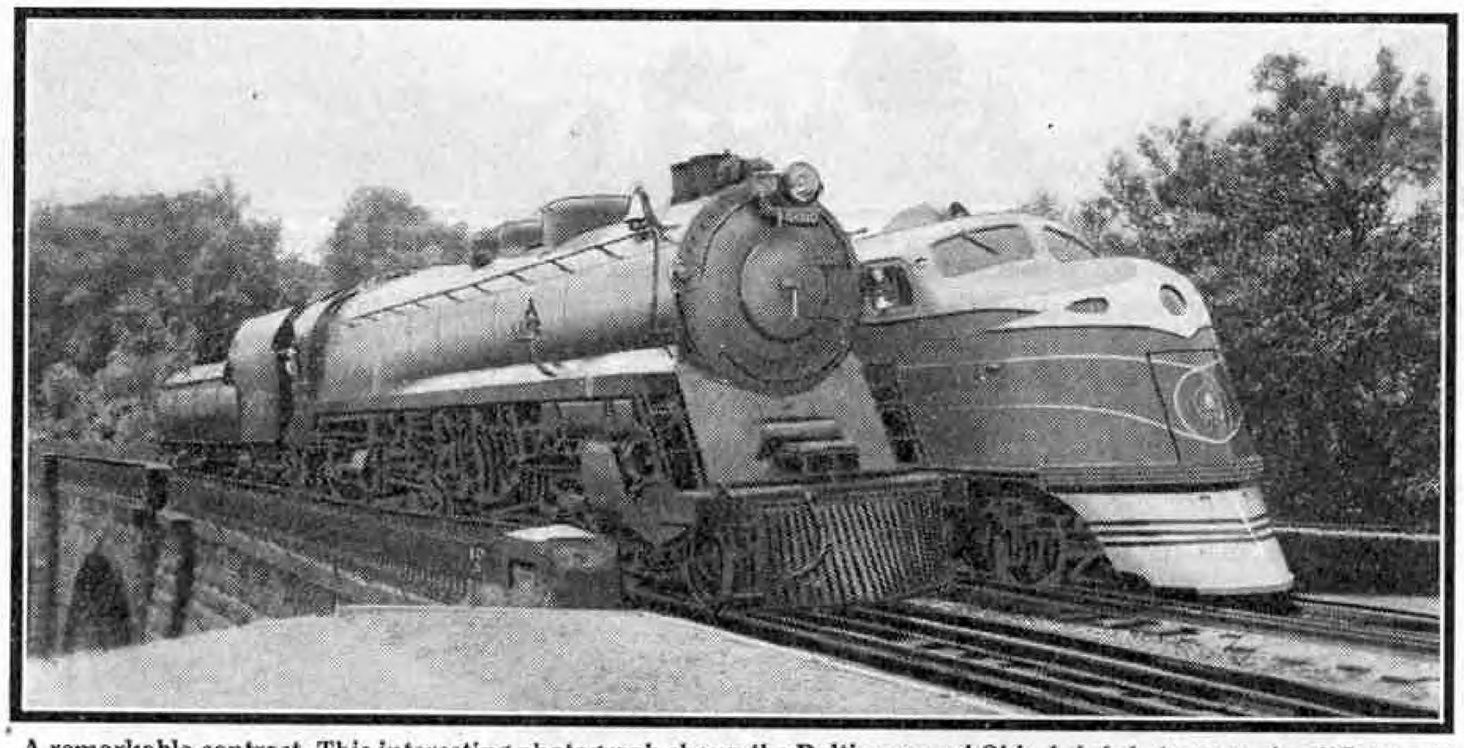
The new summer services of the main line railways involve the running of more than 2½ million extra miles by passenger trains, and an acceleration of daily services by more than 5,000 min.

The L.M.S. services to and from Scotland have been speeded up. "*The Mid-day Scot*" now runs in two portions, the first leaving Euston at 1.30 p.m. for Perth, saving 23 min., and the second at 2 p.m. for Edinburgh, with a saving of 10 min. "*The Ulster Express*" leaves Euston on Mondays to Fridays at 7 p.m., 50 min. later than previously, but there is no change in the time of arrival at Belfast by boat. The train covers the 234 miles from Euston to Morecambe non-stop. On Saturday nights there is an acceleration of 75 min. in the reverse direction. The 10.5 a.m. Glasgow to Aberdeen express has been named "*The Bon Accord,*" and has been speeded up by 12 min. on the outward run and by 38 min. on the return journey. The 1.30 p.m. train from Glasgow to Aberdeen has been accelerated by 18 min., and is now known as "*The Saint Mungo.*" The return train from Aberdeen saves 23 min.

On the L.N.E.R., "*The Flying Scotsman*" has been accelerated by 15 min., and now completes the journey of 392¾ miles between King's Cross and Edinburgh non-stop in seven hours. "*The Scarborough Flyer*" covers the 230¼ miles between King's Cross and York in 3 hr. 55 min. at an average speed of 63 m.p.h.

The outstanding feature of the G.W.R. summer programme is the running of 19 express trains at speeds of 60 m.p.h. or over. The "*Cheltenham Flyer*" is still the fastest train on the system, with an average speed of 71.3 m.p.h. The "*Cornish Riviera Express*" runs every day of the week, and from Mondays to Fridays covers the 225¾ miles to Plymouth non-stop. On Saturdays, Par is the first stopping place, a distance of 260¼ miles from Paddington. The Sunday service to Plymouth is 26 min. quicker than formerly.

On the S.R. the standardisation of departure times has been so successful that the scheme has been extended to the West of England trains. These now leave Waterloo at two-hourly intervals from 9 a.m. to 5 p.m. and at 6 p.m. The schedules of the 9 a.m. and 1 p.m. trains have been considerably improved, with savings of 18 min. to Sidmouth and Ilfracombe, and of 22 min. to Exeter. The 11 a.m. express from Waterloo, covering the difficult 83¾ miles to Salisbury in 86 min., is now the fastest non-stop run on the S.R.



A remarkable contrast. This interesting photograph shows the Baltimore and Ohio 4-4-4-4 steam engine "George H. Emerson" alongside the new Diesel-electric locomotive of the same railway. These engines are described in an article on page 493 of this issue.

Track Improvements on L.M.S.

The L.M.S. have carried out extensive track alterations in order to accommodate the new high-speed expresses that are running over the West Coast route to Scotland. Over 100 curves have been re-canted or re-aligned, and alterations have been effected at several junctions. The reconstructional work on the viaduct over the River Clyde at Lamington, Lanarkshire, has been completed, and it is now possible for trains to travel over it at considerably higher speeds than have previously been possible.

On the down main line at Hemel Hempstead, nearly one mile of new track consisting of 120 ft. rails, manufactured by the Skinningrove Iron Company, has been laid. "*M.M.*" readers will remember that the L.N.E.R. laid similar track at Holme, near Peterborough, a few months ago.

G.W.R. Build 150 Halts in 10 Years

The G.W.R. announce that a new halt consisting of two platforms and shelters is to be constructed at Mickleton, between Campden and Honeybourne. The policy of providing halts for small and growing communities has been consistently followed by the G.W.R., and in the last 10 years 150 halts have been opened in rural areas, growing suburbs and along the coast.

"The Coronation Scot" in Service

The L.M.S. *"Coronation Scot,"* made its first run on 5th July. The up train, hauled by No. 6200, *"Coronation,"* arrived at Euston 1 min. early after averaging approximately 64 m.p.h. over the 299 miles from Carlisle.

The down train was hauled by the second of the new streamline locomotives, No. 6221, *"Queen Elizabeth."* It reached a maximum speed of 95 m.p.h. between Whitmore and Crewe, and covered the 102¼ miles from Carlisle to Glasgow in 100 min. The overall average speed of this train was 62.5 m.p.h., inclusive of a stop at Carlisle. Driver Copperwheat and Fireman Blades of Camden were in charge between Euston and Carlisle, and from Carlisle to Glasgow, Driver Kerr and Fireman Sheldon of Polmadie took over after having brought the up train as far as Carlisle. Driver Curran and Fireman Scott of Upperby completed the journey between Carlisle and Euston.

The holder of the first ticket to be issued at Glasgow for *"The Coronation Scot"* was Mr. A. Findlay of Glasgow. Mr. Findlay was reluctant to part with his ticket to the collector, and after consultation with officials on the train he was permitted to retain it as a memento of the occasion.

Smart Work by a "Drummond" 4-4-0

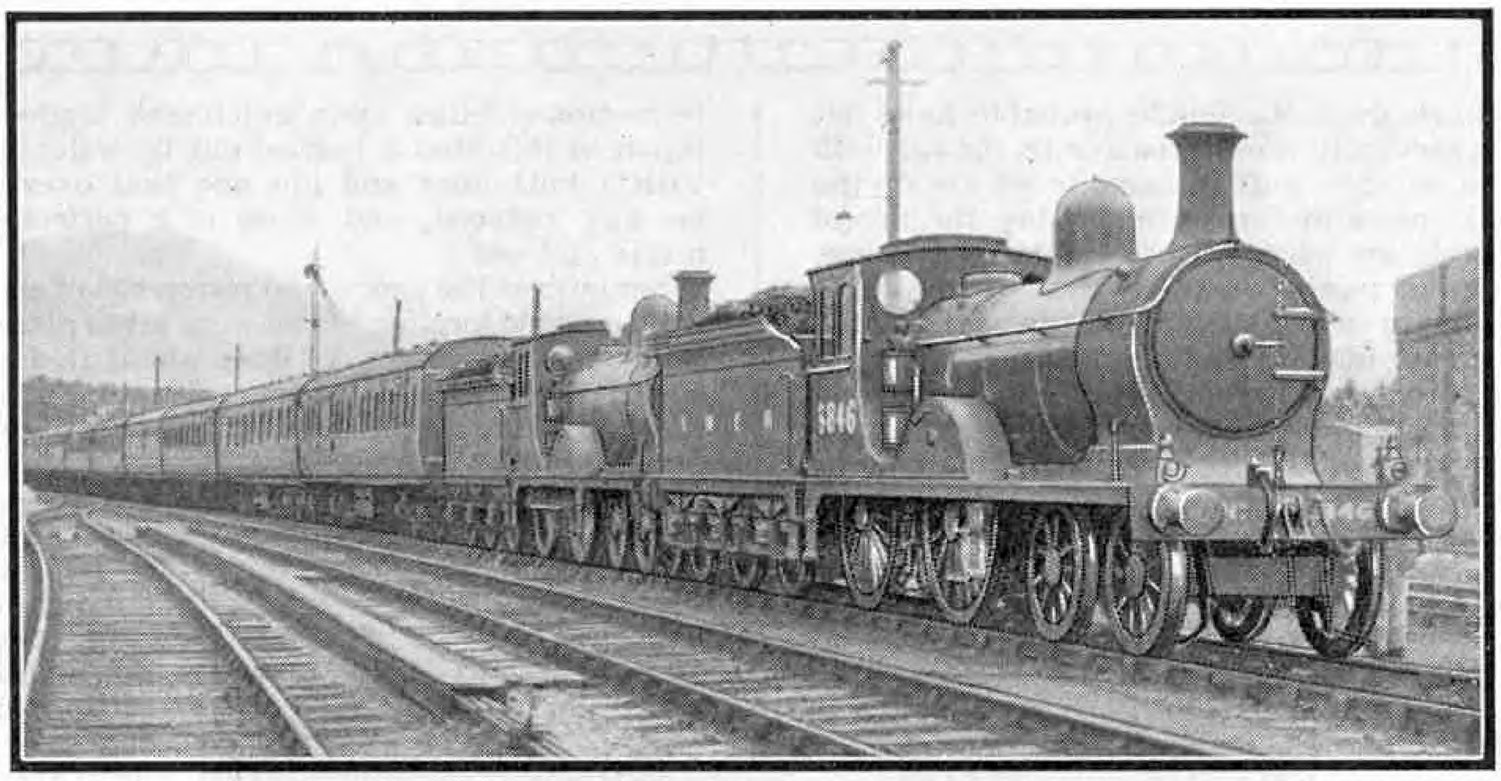
As a sequel to the article by *"Railway Engineer"* last month on express running over the Portsmouth route, some mention is due of the excellent work performed by "lesser lights" in the locomotive world before the chapter of steam traction between Waterloo and Portsmouth closed. The principal trains were all worked by "Schools." At busy times there were not enough of these for the numerous "second portions" and the smartly-timed intermediate expresses, however, and mixed traffic 4–6–0 engines, "King Arthurs," and even "Lord Nelsons" were often noted doing hard work.

The regular "first reserve" engines were the Drummond large-boilered superheated 4–4–0s of the 463–472 series, which in L.S.W.R. days did such yeoman work on the Bournemouth expresses for which they were designed. A run from Haslemere to Waterloo with No. 465 of this class, made just before electric traction was inaugurated, shows that their capabilities have not declined with advancing years.

No. 465 with nine of the latest coaches, a load of 315 tons behind the tender, ran the 8½ miles to Godalming in 10¾ min. start to stop. The half-mile of heavy ascent from the start was steadily climbed, after which speed rose to 75 m.p.h. below Witley. This particular train made stops at Godalming and Farncombe, and then ran non-stop from Guildford to Waterloo. The short runs between stops were smartly done, and then No. 465 got away in great style. Speed rose to 58 m.p.h. at Worplesdon and was carefully reduced to 35 over the junction at Woking. Then came some fast running, with speeds of 66 m.p.h. at Brooklands, 61 m.p.h. up the rise into Oatlands cutting, and 68 m.p.h. on the level at Esher.

There was a bad slack to 20 m.p.h. for station rebuilding at Surbiton, and a signal check right down to walking pace at Wimbledon; but from there the train had an absolutely clear road into the terminus—a fine tribute to the colour-light signalling. The last 3.9 miles from Clapham Junction were covered in the most unusual time of 5¾ min., with speed maintained at 50 m.p.h. until beyond Vauxhall. In spite of checks, the 30.3 miles from Guildford were completed in 40¾ min., or 36½ min. net. Over the 8.4 miles from Byfleet to Hampton Court Junction speed averaged 65 m.p.h.

These timings were recorded by Mr. O. S. Nock, and readers will be interested to compare the running of this veteran 4–4–0 with that on the footplate trip described on page 396 of last month's *"M.M."*



L.N.E.R. locomotives No. 6846, "Benachie," and No. 6847, "Sir David Stuart," double-heading an excursion train of L.M.S. stock. Prize-winning photograph by D. F. Forbes of Edinburgh.



An L.M.S. Leeds-Coventry excursion train hauled by one of the Horwich type "Moguls," No. 2722, approaching Bradway Tunnel.

Four Years to Repair a Tunnel

L.M.S. engineers have commenced the difficult task of rebuilding and strengthening the roof of Avalanche Tunnel, between Penmaenmawr and Llanfairfechan. A peculiar feature of the tunnel is that the roof is set at an angle of 30 deg. from the horizontal. This arrangement is designed to deflect avalanches over the railway into the sea below. Owing to the awkward situation of the tunnel between the mountain side and the sea, work is being carried on in great difficulties. In order to overcome one problem a light railway has been laid down on the roof of the tunnel, and a hole has been cut in the roof through which a crane lowers materials to be removed into wagons standing on the main line below. This part of the work is done at night.

In consequence of the slow rate at which the work can proceed it is expected that the scheme will not be completed for three or four years.

New S.R. Electric Services

Last month the S.R. brought into operation the new electric service between London and Portsmouth Harbour via Woking and Guildford. An interesting feature of the scheme has been the rapidity with which the work was completed. In just over 20 months 26 sub-stations were equipped and 262 track miles have been electrified.

Over 300 coaches have been found necessary to maintain the electric services to Portsmouth. The fast trains consist of four-car vestibuled sets, which can be extended to 8 or 12 coaches, according to the traffic requirements. One of the four-car sets in all these trains contains a kitchen car, so that every express has a refreshment service. The stopping trains are composed of one or more two-car units of corridor non-vestibuled stock.

G.W.R. Engine Named

Engine No. 4007, one of the 4–6–0 "Star" class, has been named *"Swallowfield Park"* in memory of Charles Russell, the first chairman of the G.W.R. who lived at Swallowfield Park, Reading, still in the possession of his descendants.

New System for Wagon Repairs

The system for repairing wagons at the L.N.E.R. repair shops at Temple Mills, Stratford, is to be reorganised. A progressive system of repairs is being adopted so that crippled wagons enter the shops at one end, and proceed by degrees until they emerge at the other end in a first-class condition ready for traffic again.

Oxy-Acetylene and Electric Arc Welding

Metals Joined at White Heat

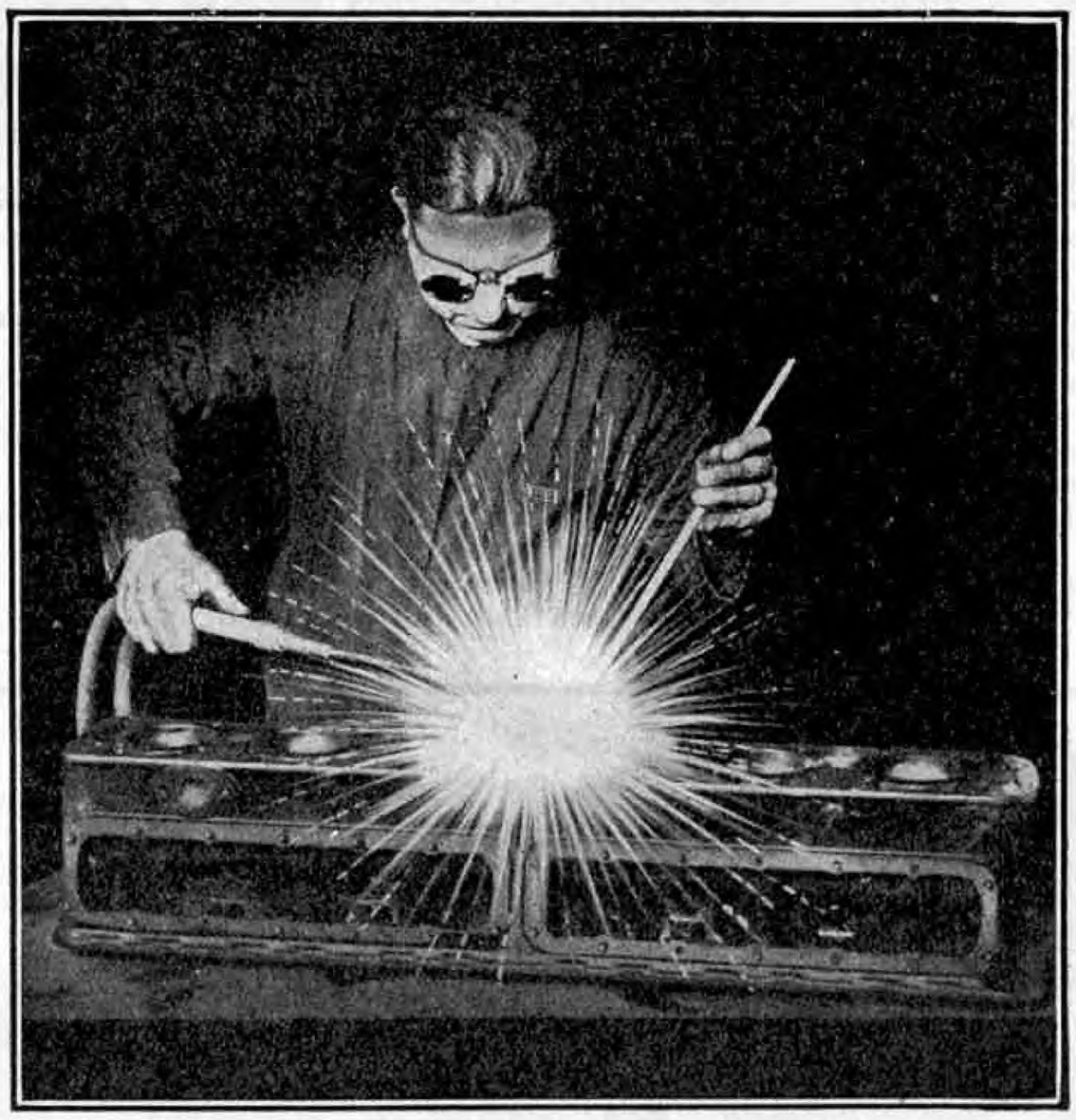
By C. W. Brett, M.Inst. W.

IF we had lived in prehistoric days, we should probably have felt the handicap of having practically no alternative to thongs with which to bind flints in the wooden haft of axes, or to use in the construction of some crude piece of furniture. To-day the use of screws, nuts, bolts and rivets are accepted as a matter of course.

The most modern means of joining metal is that of fusion, or welding, as it is more commonly called. Welding as practised by the blacksmith is a very ancient art, in which metal is hammered after it has been made white hot. Modern scientific welding is an entirely different matter, however, for in order to obtain perfect union such intense heat is used that the metal becomes fluid. This can be accomplished by using a blowpipe in which oxygen and acetylene are burned together, generating a temperature of about 7,000 deg. F. The electric arc also is widely used for welding purposes, and there are other methods, but the two systems mentioned are by far the most generally employed.

There are few people to whom the sight of an oxy-acetylene torch is not familiar, for it is an invaluable item of equipment when it is necessary to cut out sections of tram track, or to deal with large iron pipes, sections of which are frequently fused to form a continuous length.

Electrical welding is more commonly employed upon steel work, such as the building of ships and the erection of many modern buildings. It is also used for what is known as spot welding, in which small metal parts, such as the handle of a saucepan, are fitted in position by passing through them, at the point of attachment, current of relatively low voltage but high amperage. The resistance that is set up causes the parts to be fused together. Sometimes this work is done automatically and the machine in which the components are held releases them directly the operation is completed.



An oxy-acetylene welder repairing a motor car cylinder block. In his left hand is the welding feed rod, of the same composition as the metal he is working upon. The illustrations to this article are reproduced by courtesy of Barimar Ltd.

The surprising results that are being achieved by fusion for a wide variety of repairs excites more popular interest, however. Railway engineers are finding such methods not only reliable but economical, for many parts that a few years ago would inevitably have been scrapped are now being saved for long periods of further service. Locomotive cylinders that have become cracked in the course of normal duty are repaired with complete success, and new railway engines are being erected on which many forged, cast and riveted parts have been eliminated by fusive methods. In some instances even the cylinders and valve housing assembly are fabricated entirely by welding, the only cast portions being the liners. The same thing is happening in regard to smoke-box saddles and many other simple items, such as the ashpan. One of the most notable advantages of welding is that there is no loss of strength, and there may even be an increase, while there is a reduction in weight that averages about 25 per cent.

Boilers in particular offer considerable scope for the welding operator to exhibit his skill. A trouble which is common to many boilers, including those employed for locomotive work, is that of grooving. As the word implies, the metal becomes furrowed in certain places and naturally that at the bottom of the grooves wears thin, so that repair is necessary if pressure is to be maintained safely.

The old method was to cut out the defective portions and rivet a patch in position, but the necessary overlapping caused the formation of ledges upon which scale tended to accumulate. When a repair of this kind is carried out by welding, the new plate is fitted with a butt joint and not one that overlaps. The strength is in no way reduced, and there is a perfectly smooth surface both inside and out.

Sometimes the piston and piston rod of a locomotive are machined from a single forging. When wear takes place on a component of this kind something must be done about it, for a replacement costs a considerable sum of money. Nowadays new metal is fused in position, after which the worn parts are machined to their original dimensions.

Obviously perfect bearing surfaces are required, and until quite recently there was a likelihood of small pit marks in the weld, notwithstanding the utmost care being taken in the subsequent machining and grinding. This pitting was due to the action of the oxygen in the atmosphere upon the metal while it was in a molten condition, and the problem was how to eliminate this factor. After considerable experimental work a method was discovered whereby welding of this class could be undertaken while the metal was enveloped in hydrogen. The welded metal is then freed from the unwelcome effect of the oxygen in the air, and it is impossible to detect that the work has been done, except by the use of a microscope.

There are two ways of supplying this "field" or atmosphere of hydrogen. One is by the use of high pressure cylinders containing the required gas. The other system is rather more ingenious, for the welding rod is coated with a chemical that gives off hydrogen freely directly it is heated, and this of course takes place as the work proceeds.

Quite apart from the repair and fabrication of locomotives, fusive methods of construction are being used for rolling stock. In this country steel coaches are not employed to anything like the extent that they are in America, or on the continent, but this form of construction offers almost unlimited opportunity for the use of welding methods. Bogie frames are frequently built up in this manner and many of this type are in use on London's underground railways. A great deal of wear takes place in axle-box horn guides, and to overcome this difficulty special wear-resisting steel is sometimes welded in position.

At one time when rolling stock wheel hubs became worn scrapping often followed, but nowadays liners are fused in position, thus restoring the wheels to their original condition, or at least giving them a greatly increased lease of life.

Shipping is another branch of industry that benefits from welding. Imagine the dilemma of a shipowner who found that one of his large cargo boats, which had almost finished loading and was about to set sail for Havre, could not leave because the main frame of one of the most important winches on board was fractured in several places. To obtain a new part at a moment's notice was quite impossible, and several weeks must elapse before a replacement could be secured. Without the use of the winch it was futile to depart, for the goods could not be handled at the point of destination.

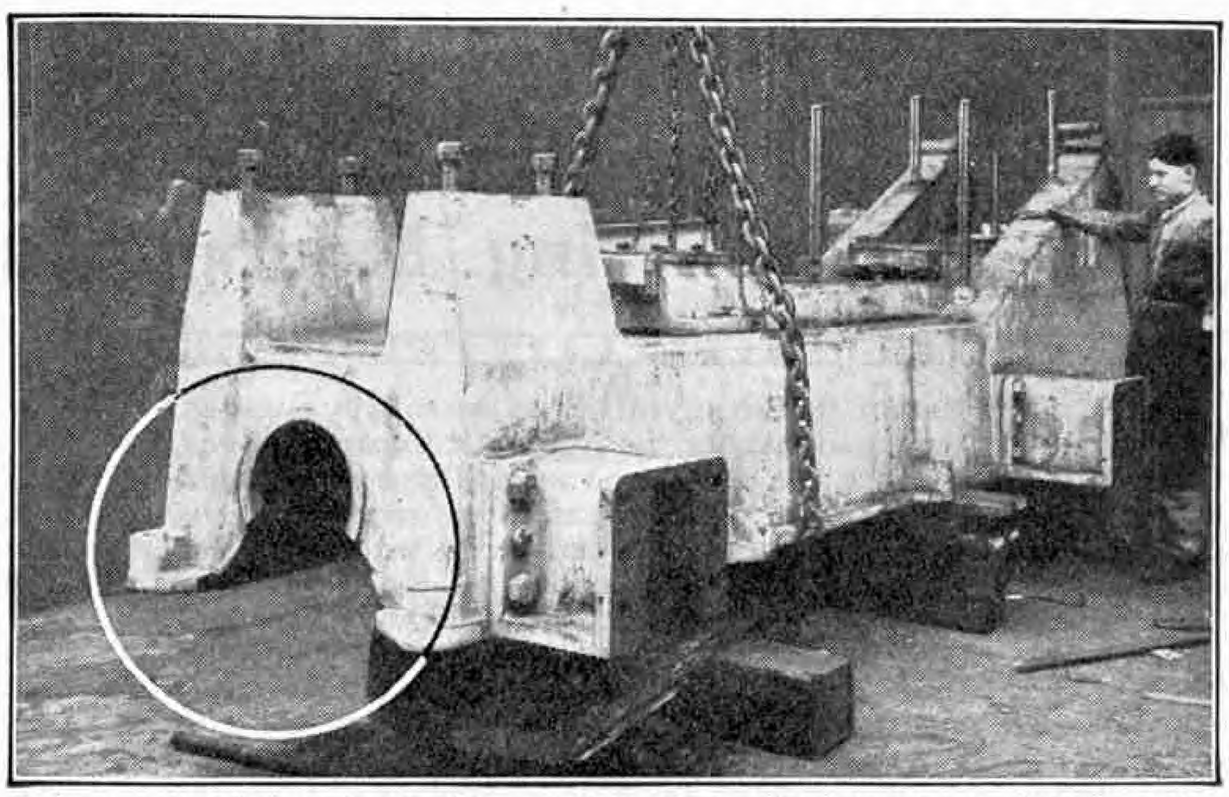
Local opinion regarded a repair as being impossible, but demurrage charges were mounting up and something had to be done. Ultimately it was decided to send mobile welding equipment, together with several high skilled operators, and a British firm of

scientific welding engineers were entrusted with the job. By dint of working night and day the repair was completed in record time and to the satisfaction of Lloyds' engineer, and the actual cost of the work was small in comparison with the loss of thousands of pounds that would have followed an extended delay.

Another interesting case of sudden breakdown concerned a large motor tug on the Thames. Without the slightest warning the crankshaft of the vessel's Diesel engine broke across a web, and in the resulting smash it was considerably distorted. The engine was quickly dismantled and welding operators at once commenced to unite the broken shaft, after which it was trued with such accuracy that it could be checked to the usual tolerance of one thousandth of an inch. This shaft was about 14 ft. in length and has since given faultless service.

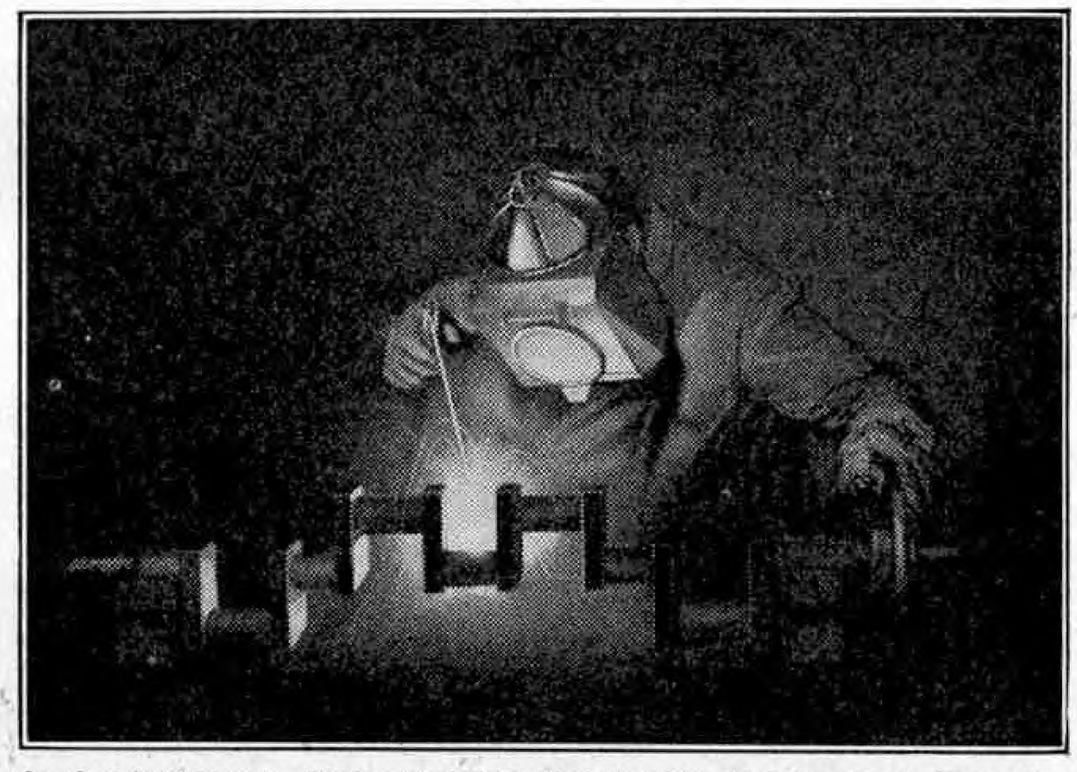
Some time ago a firm of scientific welding engineers, who carry out a great deal of crankshaft repair work, maintained careful records of six hundred shafts of various types which had been broken and welded. Only in one case was there further breakage, and this occurred at a point remote from the weld and was found to be due to a hidden flaw in the forging.

Some ships are constructed almost entirely by fusive methods, whilst repair work to shipping of all kinds would indeed be laborious without the facilities afforded by the oxy-acetylene and electric arc. Many marine and stationary oil engines have main frames and other components built up from sheet steel by welding methods. The result is greatly reduced weight, but increased strength, for the steel takes the place of massive iron castings that are more liable to damage.



An 8-ton casting that was broken in transit, the broken portion being shown within the circle. This was repaired by welding, as shown in the illustration at the foot of the page.

It is not uncommon for serious accidents to happen to engines in the process of manufacture, for sometimes castings weighing many tons, and upon which extensive machine work has been done, are accidentally dropped and important portions are broken away. When this happens it is no longer necessary to scrap the damaged part, for the broken pieces can be fused into place once more without any reduction in strength. Not infrequently a mammoth tractor will pull up at the works of a welding engineer in order to unload a single machine, part of which may weigh 12 tons or more. In other cases the nature of the job prevents transport, so that the welding work must be tackled on the site. This can readily be done, and in one way or another welding repairs can be carried out with machines of any size.



An electric welder repairing a crankshaft. This class of work is frequently done with a hydrogen field surrounding the welding arc, as this keeps out oxygen and prevents pitting in the weld.

During the winter months frost causes innumerable breakages as a result of leaving water in the cylinder jackets of motor car and lorry engines, air compressors and other machinery. As a rule a welding repair is relatively simple, provided that the operator is thoroughly experienced and equipped with the somewhat complex apparatus needed. Both these points are important. For it must not be thought that anyone using an ordinary oxy-acetylene blowpipe can apply the flame to the broken metal and expect it to flow together, for burning would result together with all sorts of other unfortunate consequences.

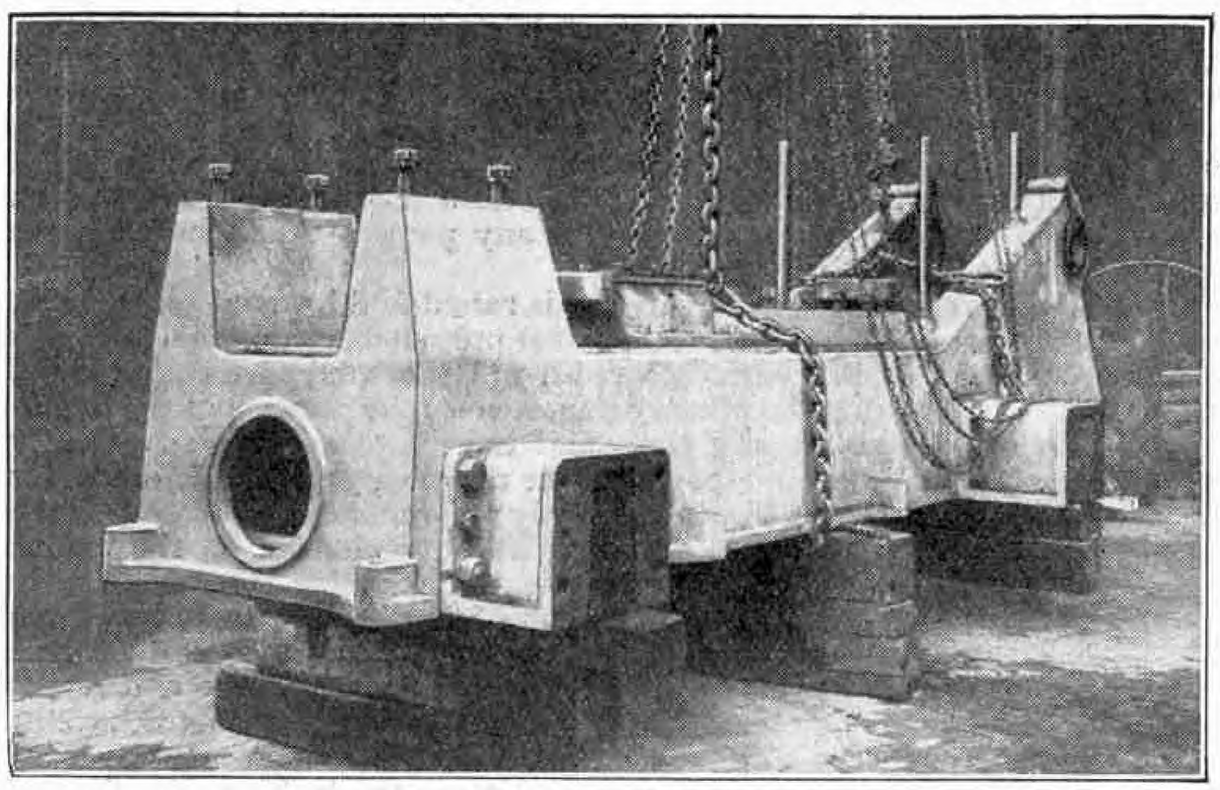
It is for this reason that there must be careful investigation of every job which is undertaken. Sometimes it is necessary to analyse the metal before work is commenced, so that the material of which the weld is composed may be identical. In other cases heat treatment is of vital importance and it is essential, in some instances, to pre-heat the part needing attention before welding can be commenced. This is necessary because of the sudden local expansion of the metal due to the high temperatures employed, which gives rise to strains. These are released by pre-heating, but a British low-temperature process developed recently has practically eliminated this need.

It is encouraging to record that Great Britain is regarded as being pre-eminent in welding activities, and this largely accounts for the volume of machinery parts shipped for repairs to this country from all parts of the world. Even the United States makes use of the welding service offered by British engineers, and two recent examples from this quarter are of particular interest. One was a complete differential, the cage of which was smashed into many fragments, whilst the pinions also were damaged. A replacement was not available, but welding was successful and when the owner saw the result of the welder's art he could have been forgiven if he had thought that a replacement had been found, for the repaired cylinder block is indistinguishable from a new one.

The other example was a cylinder block in which were steel, aluminium and cast iron. Three large engineering concerns in New York stated that repair by welding methods could not be satisfactory because of the different rates of expansion of the metals. Within 30 days of despatch from the States the cylinder block was back again, however, and after several months of constant service the work done has proved satisfactory in every way.

It must not be imagined that fusive engineering only concerns those who have the responsibility of the repair and maintenance of large and important machinery. Many model making enthusiasts have suffered the woeful experience of bestowing much care and attention on the machining of a cylinder, or some other component, and then, when the work is nearly finished, of making a slip that causes what at first sight appears to be irreparable damage. It is seldom that welding cannot overcome a difficulty of this kind, however, and at a small cost the fault can generally be overcome without leaving any trace of union or replacement of metal.

For the information in this article we are indebted to the courtesy of Barimar Ltd.



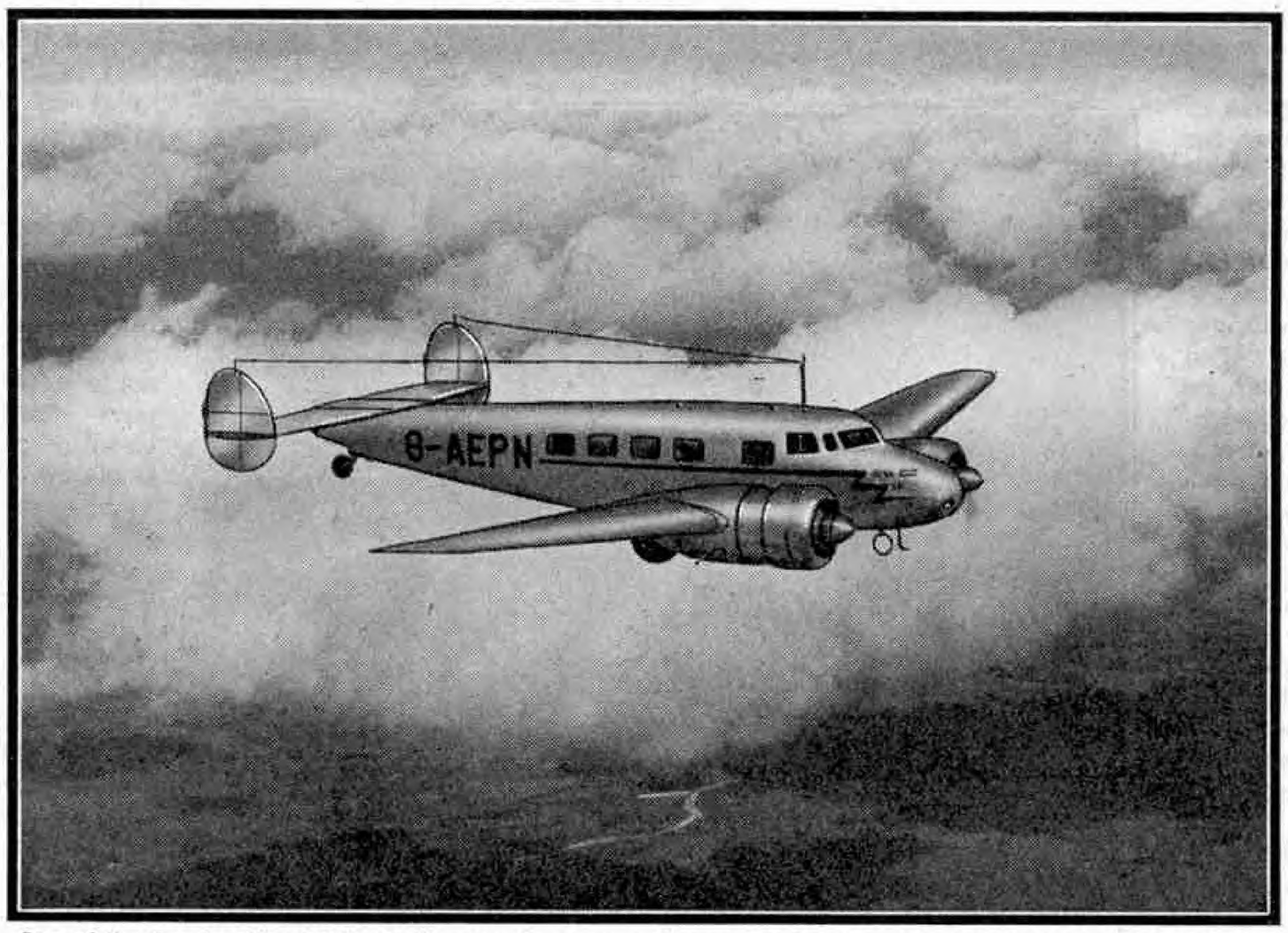
The 8-ton casting shown in the illustration at the head of this page after treatment by the welder, followed by machining. There is no sign of the weld in the repaired casting, and this was entirely satisfactory in use.

The Lockheed "Electras" of British Airways

Low Wing Monoplanes of High Speed

ALMOST all important British aircraft firms are so fully engaged in making military machines for the Royal Air Force that they have little time to give to the production of civil and commercial aircraft. The result is that Air Line Companies are acquiring aeroplanes from overseas, and particularly from the United States. For instance, British Airways Ltd. have added to their fleet five Lockheed "Electras," one of which is shown in flight in the illustration on this page. The new machines are being used for the *"Viking Royal Mail Express"* service between London and Stockholm, and also in regular service flights between London and Paris.

The "Electra" is a twin-engined low wing monoplane of all-metal construction. It is thoroughly modern in design, for it is well streamlined and has a retractable undercarriage, airscrews of variable pitch and de-icers on the wings. The standard engines are Pratt and Whitney 400 h.p. "Wasp Juniors," which give a top speed of 210 m.p.h., and a cruising speed of 175 m.p.h. The Scandinavian and Paris services of British Airways have been speeded up since the introduction of these fast machines, and Stockholm is now reached from London in 7 hrs. 20 min. flying time. The machine climbs at the rate of 1,100 ft. per min. and its service ceiling is 21,150 ft.



One of the five Lockheed "Electra" monoplanes operating on the Scandinavian and Paris services of British Airways Ltd., to whom we are indebted for this illustration. These American twin-engined air liners have a top speed of 210 m.p.h., and seat 8 passengers.

The Lockheed "Electra" was introduced in 1935 and is one of a long line of remarkable passenger and freight carriers produced by the Lockheed Aircraft Corporation, California. The earliest of these machines appeared in 1916, when Alan and Malcolm Loughead, the founders of the firm, produced the forerunner of the true streamline aeroplane. The name was changed to "Lockheed" in 1926, and the "Vega" and other machines then followed. A Lockheed "Vega" was used by Sir Hubert Wilkins in his great pioneer flight across the Arctic Ocean from Alaska to Spitsbergen in 1928.

The cantilever wings of the "Electra" are built entirely of a light alloy, with a smooth outer skin that takes the stress. The most interesting feature of the wings is the Goodrich de-icing equipment fitted to them. This consists of a rubber tubular coating over the leading edges, through which air is blown by means of a motor driven pump. The pressure of the air varies, giving a pulsating effect that causes the tube to expand and contract alternately. Ice forming on the tube is then cracked, and the pieces are blown off by the slipstream.

Duralumin, the well known light aluminium alloy, is the principal material employed in the construction of the fuselage. In twin-engined aeroplanes the nose of the machine is available as stowage space, and that of the "Electra" forms the main baggage compartment. Behind it is the pilot's cabin, with seating for two. An illustration of the interior of this appears on page 448 of this issue, and the formidable array of knobs, dials and levers at once attracts attention, for there are many more controls and instruments than are to be seen in British commercial aircraft. There are so many, in fact, that it seems impossible for the pilot to pay attention to them all, but many of them are not intended for constant reference while a flight is in progress.

In addition to the usual navigating equipment, there is a Lorenz ultra-short wave approach receiver, which at night or in bad weather guides the pilot to the Croydon or Gatwick airports, where Lorenz blind flying equipment is installed. The receiver in the Lockheed "Electras" of British Airways is the first of a new type to be fitted in aircraft.

When two pilots are carried the first occupies the seat on the left. He has in front of him a sloping shelf on which are the essential electrical switches and fuses, and the de-icer regulator, and alongside him is a master switch for the whole of the electrical equipment of the machine. On a similar shelf in front of the second pilot is the remote control panel of the Marconi two-way radio set that forms part of the machine's equipment. Thus when the aeroplane is being used on a service requiring only one pilot, the radio operator can occupy the second pilot's seat. When two pilots are necessary the radio operator sits in the wireless compartment between the cockpit and the main passenger cabin.

Remote control also has been adopted in connection with the radio direction finding equipment, the loop aerial of which is carried below the fuselage. The panel from which this equipment is operated is fitted on the roof of the pilot's cabin in a position where it can easily be reached from each of the two seats. A battery driven transformer supplies power for the radio set and the direction finding apparatus.

A bulkhead in which there is a door separates the pilot's cabin from that for passengers, a long, comfortable compartment that is slightly lower than in some British air liners. It is claimed that this sound-proofed passenger cabin is the quietest of any multi-engined aeroplane in the world, and even when the bulkhead door is open, passengers can converse in ordinary tones. The 8 seats are arranged in two rows of 4, separated by a central gangway. Large windows enable the passengers to enjoy a clear view, and above the windows are fresh-air ducts with adjustable openings so that the passengers can regulate the flow of air. There is a reading lamp above each seat, and a press button so that any passenger can summon the pilot in case of emergency.

The retractable undercarriage is raised and lowered electrically, but emergency hand control for it is provided beside the first pilot's seat. An indicator with coloured lights, mounted near the centre of the dashboard in the pilot's cabin, reveals the position of the undercarriage wheels at any time, and the pilot cannot inadvertently throttle back the engines before the undercarriage is fully down, for then a Klaxon horn hoots vigorously as a reminder. When raised the wheels are drawn into recesses in the underside of the engine nacelles, but they protrude sufficiently to enable the aeroplane to make a safe landing in the event of any failure to lower them.

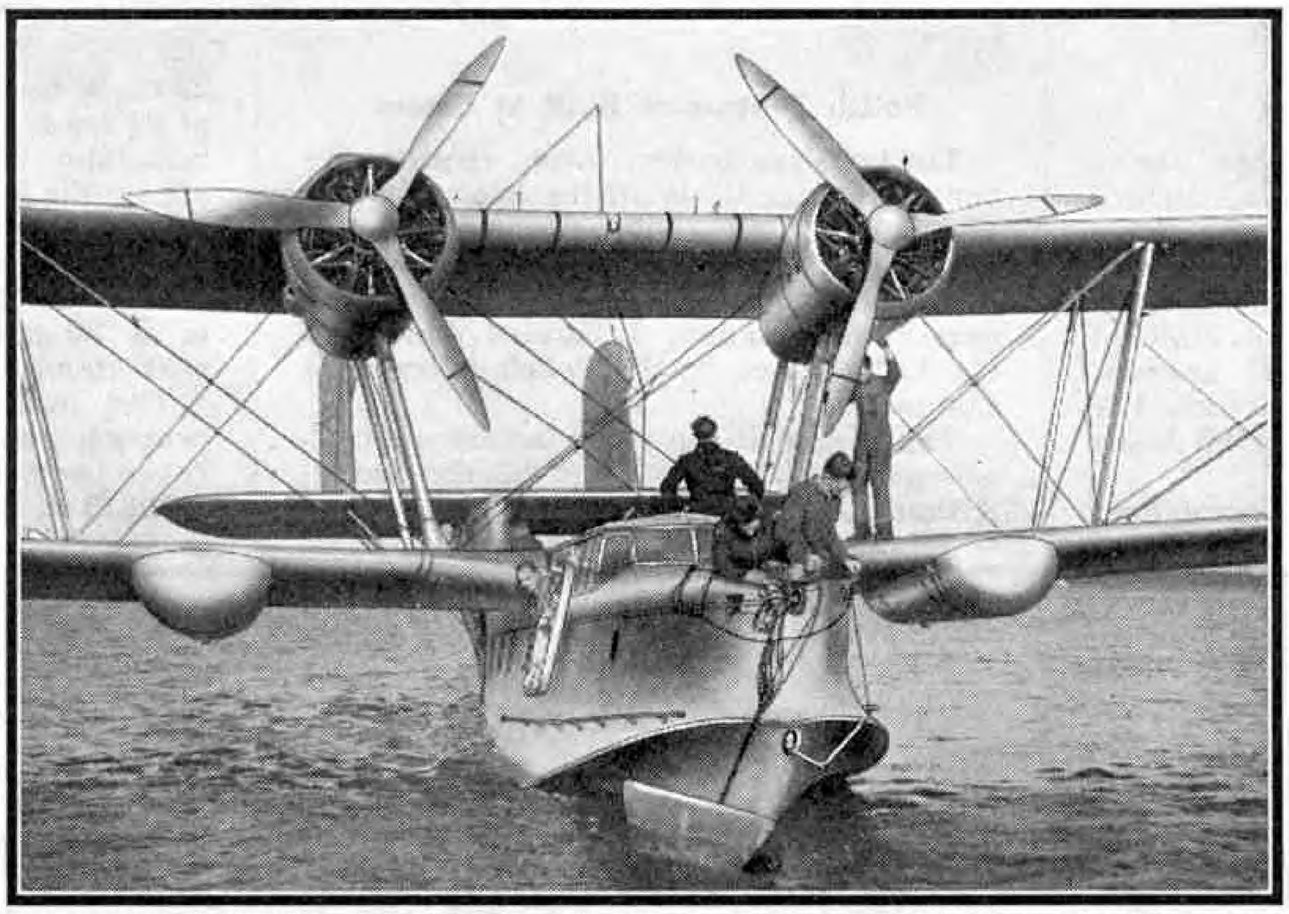
The tail unit of the machine is of the wide, twin rudder type made familiar in this country by the Monospar S.T.25 and recent types of heavy bombers. The tail-plane is bolted at the middle to the fuselage, and the trailing edge has an adjustable flap that can be manipulated from the cockpit, as also can the trailing edge flaps of the rudders hinged to the two vertical fins. These flaps, and the landing flaps fitted to the wings, are operated electrically.

Flying Boats for Defence Duties

Vickers Supermarine "Stranraer" and "Walrus"

THE general reconnaissance squadrons of the Coastal Command of the Royal Air Force carry out reconnaissance flights over the sea from coastal aerodromes, using military landplanes specially designed for this duty. This measure of protection is adequate in time of peace, but in the event of any threat of attack it would be necessary to keep watch over a much greater distance seaward, and this responsible task would fall to flying boat squadrons.

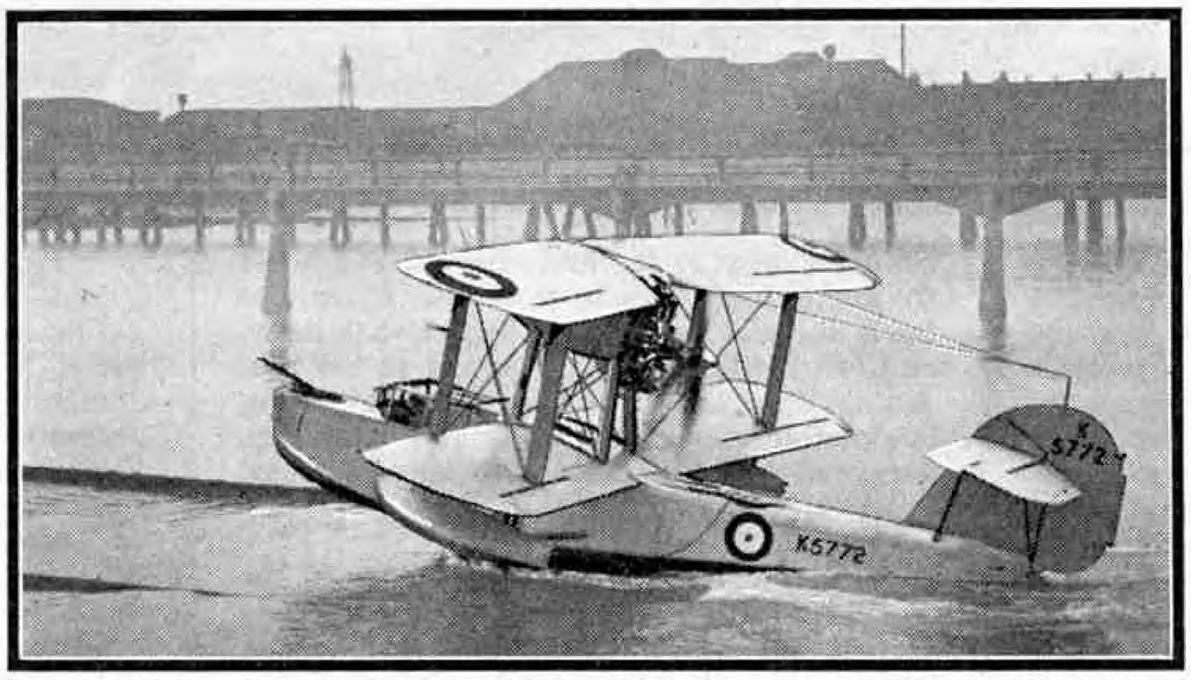
Vickers Supermarine aircraft have for many years been included among the varied types of flying boats used by these squadrons. A typical modern example is the Vickers Supermarine "Stranraer," shown in the upper illustration on this page. This large twin-engined flying boat is much more than a reconnaissance machine, for it can be used also for bombing enemy ships, as a torpedo-transport, and for training and navigational instruction. The high efficiency and seaworthiness of the "Stranraer" were convincingly demonstrated during its Service trials, when it was operated in gale conditions.



A near view of the Vickers Supermarine "Stranraer" twin-engined flying boat. The illustrations on this page are reproduced by courtesy of Vickers (Aviation) Ltd.

The "Stranraer" is built entirely of metal. The chief material employed is a light metal called "Alclad," which is a composite consisting of a layer of duralumin between two thin layers of pure aluminium and has become very popular for marine aircraft owing to its ability to resist corrosion. The upper and lower wings are of unequal span, they have a framework of "Alclad" spars and ribs, and are covered with doped fabric.

The two nacelles for the engines are spaced well apart and are built into the underside of the centre section of the top plane. They are supported by two pairs of inclined struts, the lower ends of which are attached to the bottom wings near the junction of these with the hull. The centre section of the top plane also contains the two 250-gall. petrol tanks, and the two oil tanks, each of 19½-gall. capacity, are shaped to form the leading edge of the section. The tail unit is of the monoplane type with twin fins and rudders, and the metal framework is covered with fabric. The massive "Alclad" hull is covered with smooth plating of the same metal, and all the important fittings are made of stainless steel.



Another Vickers Supermarine aircraft, the "Walrus" single-engined amphibian. It is used by the Fleet Air Arm for reconnaissance duties.

The internal arrangements of the "Stranraer" are interesting. In the bow of the hull is a cockpit with gun position and bomb controls, and there is a hinged watertight door in the bow for bomb-sighting. Next to the cockpit is a compartment in which the mooring tackle is stowed, and behind the cockpit is the pilots' cabin, with sliding roof and side panels and hinged windscreens.

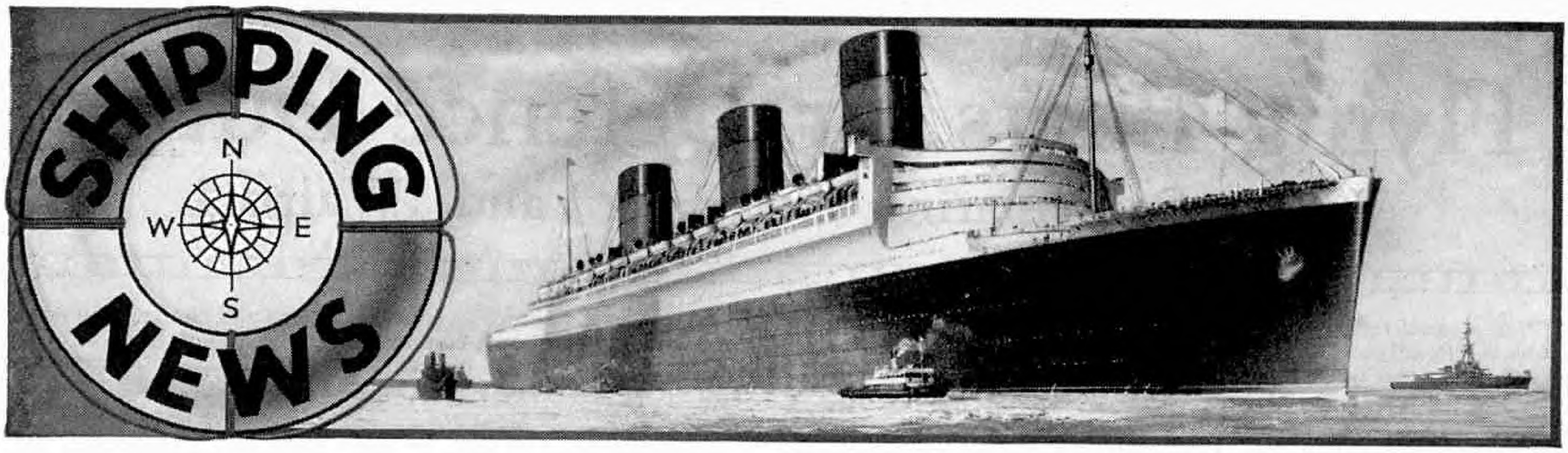
The navigator and the engineer occupy a large well-lit cockpit, placed immediately behind the pilots' cabin and containing a table on which the navigator can spread his maps and charts. The next compartment farther aft contains the radio installation. Behind it is one of two rear gun positions, the other being in the extreme stern of the hull. The equipment of both gun positions includes windscreens to protect the occupants from the weather. The flying boat may be required to undertake long cruises, or urgent long-distance flights. The interior of the hull is therefore sufficiently roomy for the occupants to sleep in it and to cook their meals.

The engines of the "Stranraer" are of the Bristol "Pegasus" air-cooled type, and conveniently placed openings in the nacelles enable all parts of the engines to be periodically inspected. Both electric and hand starting mechanisms are provided.

There is a limit to the distance aircraft operating from a coastal base can fly. Reconnaissance flights in mid-ocean, or far out at sea, therefore are carried out from floating bases, which may be either aircraft carriers or naval vessels specially equipped to launch one or more aeroplanes from their decks.

The Vickers Supermarine "Walrus" amphibian shown in the lower illustration on this page is one of the types of aircraft thus employed. It is a combination of flying boat and landplane, and has the distinction of being the first amphibian type of aircraft to be catapulted with full military load from a warship of the British Navy. The "Walrus" was designed specially for fleet-spotting duties, and since its adoption by the Admiralty for the Fleet Air Arm it has been supplied to naval vessels equipped with catapult launching gear. Another point of interest is that it is the only single-engined "pusher" machine in the Fleet Air Arm, the engine being fitted so that the airscrew is outside the trailing edge, instead of the leading edge, of the wings.

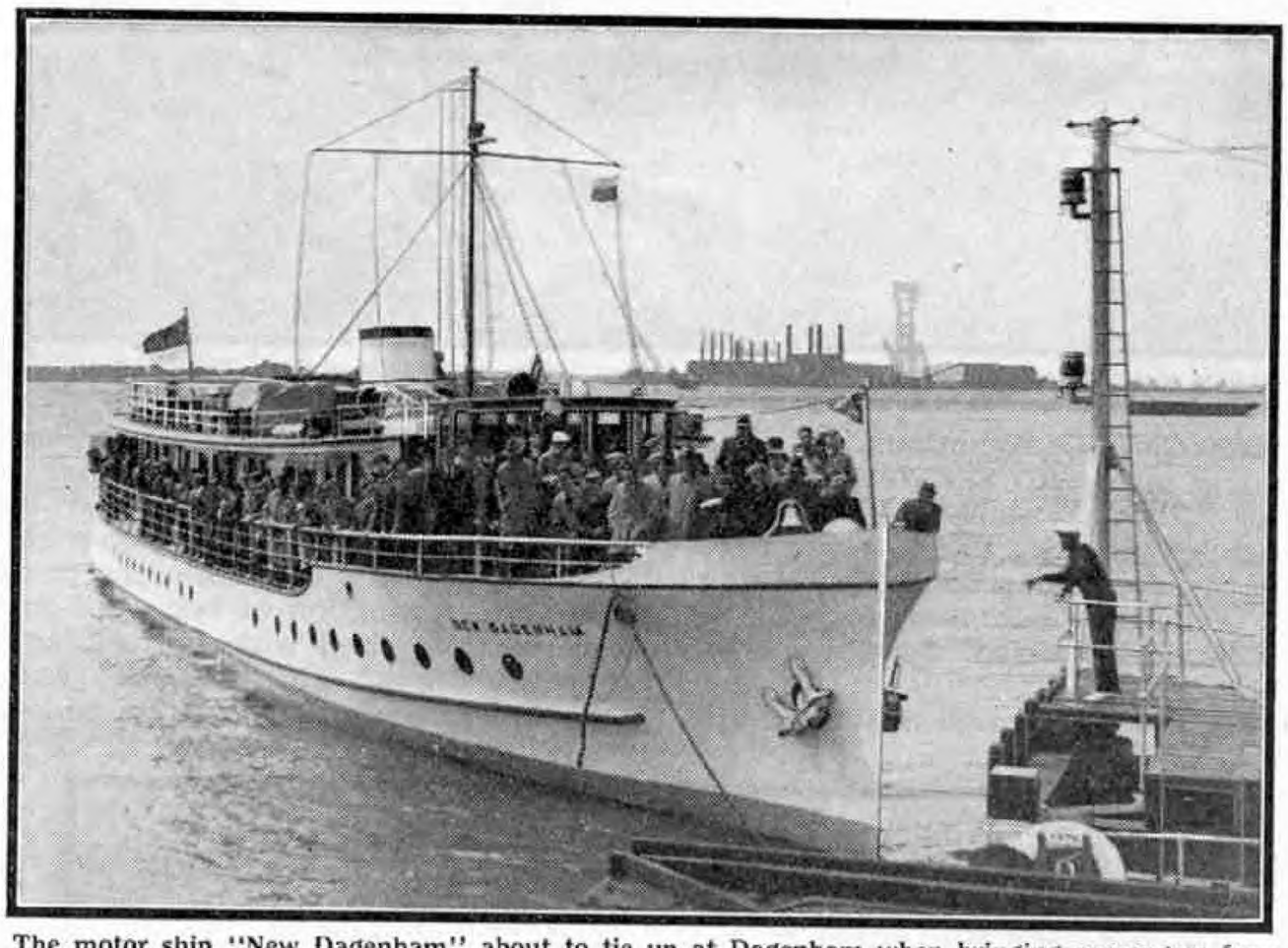
The superstructure of the "Walrus" is of the unequal-span biplane type, and the outer sections of the wings are hinged so that they can be folded back. The wing spars are of stainless steel, and the minor parts are of spruce and three-ply. The covering is of fabric. The hull has almost the slender lines of a light civil aeroplane, and the flat sides add to this impression of slimness. It is a single-step structure, and is built of a specially-treated aluminium alloy, with twin floats of the same material. There is a gun position in the cockpit in the bow, and also room for stowing the marine gear. The enclosed cabin for the pilot is just behind the cockpit, and has seating for two, the pilot occupying the left-hand seat. Farther aft are compartments for the navigator and radio operator, and well clear of the wings there is a rear cockpit for a second gunner.



Cruises on the Thames

The illustration on this page shows the motorship *"New Dagenham,"* which is owned by the Ford Motor Co. Ltd., and cruises on the Thames between Westminster Pier and the Ford works at Dagenham. The vessel was built in Holland and is driven by twin Diesel engines, which are started by electric motors. The fuel tanks hold sufficient oil for 98 hours continuous running.

The vessel is centrally heated throughout and has accommodation for 250 passengers. It is used for taking visitors to and from the Ford works.



The motor ship "New Dagenham" about to tie up at Dagenham when bringing passengers from Westminster Pier to visit the Ford Motor Works. Photograph by courtesy of the Ford Motor Co. Ltd.

The 1937 Grain Ship Race

Early every year there is great activity at the wheat ports of Australia, where lorries and wagons bring to the docks hundreds of thousands of bags of wheat, which are then loaded into the holds of the sailing vessels. When loaded to capacity each ship sails for England, usually for Falmouth. "Falmouth for orders" is a well-known phrase among the crews. Eight weeks may separate the departure of the first and last ships, but those that get away in January have the advantage of the strong westerlies to carry them round Cape Horn.

The struggle between these sailing vessels to record the fastest time for the voyage produces intense rivalry. This year 14 ships took part in the unofficial contest that has been described as the world's greatest ocean race, and the winners were the *"Pommern"* and the *"Passat,"* each of which took 94 days for the passage. The *"Pommern"* is a steel four-masted barque with a length of 310 ft. 6 in. and a tonnage of 2,376. She was built in 1903 at Glasgow and taken over in 1925 by Captain Gustaf Erikson. Captain Erikson also owns the *"Passat,"* which is a similar vessel to the *"Pommern,"* having a length of 322 ft. and a tonnage of 3,183.

The next fastest passages were made by two other vessels of Captain Erikson's fleet. These were *"L'Avenir,"* which took 95 days, and the *"Lawhill,"* which occupied 106 days. The former ship has recently been sold to the Hamburg-Amerika Line for use as a training ship. Both vessels are four-masted barques of 2,738 and 2,816 tons respectively.

Polish Destroyers Built at Cowes

The Polish destroyer *"Grom"* recently ran her acceptance trials off the Isle of Wight. She fulfilled all contract conditions for speed, oil-fuel consumption, stability and manœuvrability, and was officially handed over by her builders, J. Samuel White and Co. Ltd., Cowes, to the Polish Acceptance Committee.

The *"Grom"* is one of the largest and fastest warships of her type in the world. Although her length is 374 ft., she has a beam of only 37 ft., and this feature helps to make high speeds possible. After her trials she was taken over by a Polish crew, and left for her home dockyard at Gdynia. A sister ship, the *"Blyskawica,"* is now being completed afloat at Cowes and trials are expected to take place late this summer.

Sir Malcolm Campbell's Motor Boat

Sir Malcolm Campbell, the holder of the world's motor car speed record, has now turned his attention to motor boating, and a speedboat specially designed for him was launched on Loch Lomond late in June. This boat was named *"Bluebird,"* and after her launch she was housed in the shed occupied in 1932 by *"Miss England III,"* in which Mr. Kaye Don established a record of 119.81 m.p.h. This was exceeded by Mr. Gar Wood later in the year, and the speed of 124.86 m.p.h. then attained still stands as the record.

The *"Bluebird"* was built by Saunders Roe Ltd., East Cowes, and has a length of 23 ft., a beam of 9 ft. 6 in., and a weight of 2¼ tons. A Rolls-Royce vee 12-cylinder Schneider Trophy-type engine is installed aft in the boat. This develops 2,350 h.p. at 3,200 r.p.m. and runs on special Ethyl fuel. The supercharger fitted is designed to run at 25,600 r.p.m. Fuel is carried in a 30-gallon tank amidships on the port side.

The hull of the boat is beautifully proportioned, and a streamline metal cover extends from the cockpit to a point 3 ft. beyond the stern. The cover and deck are aluminium colour, and the hull is finished in the blue used for Sir Malcolm's famous record-breaking motor car. A novel feature is that 240 gross table tennis balls are stowed under the fore deck to provide reserve buoyancy.

Only two runs were made over the measured mile on Loch Lomond because of bad weather, and in one of these a speed of 85 m.p.h. was reached. Heavy rains that brought driftwood into the loch made further runs dangerous, and Sir Malcolm therefore decided to look for a suitable stretch of water elsewhere on which to continue them. The runs on Loch Lomond have given valuable technical information that will prove useful in later tests. It is possible that these will be carried out in Italy.

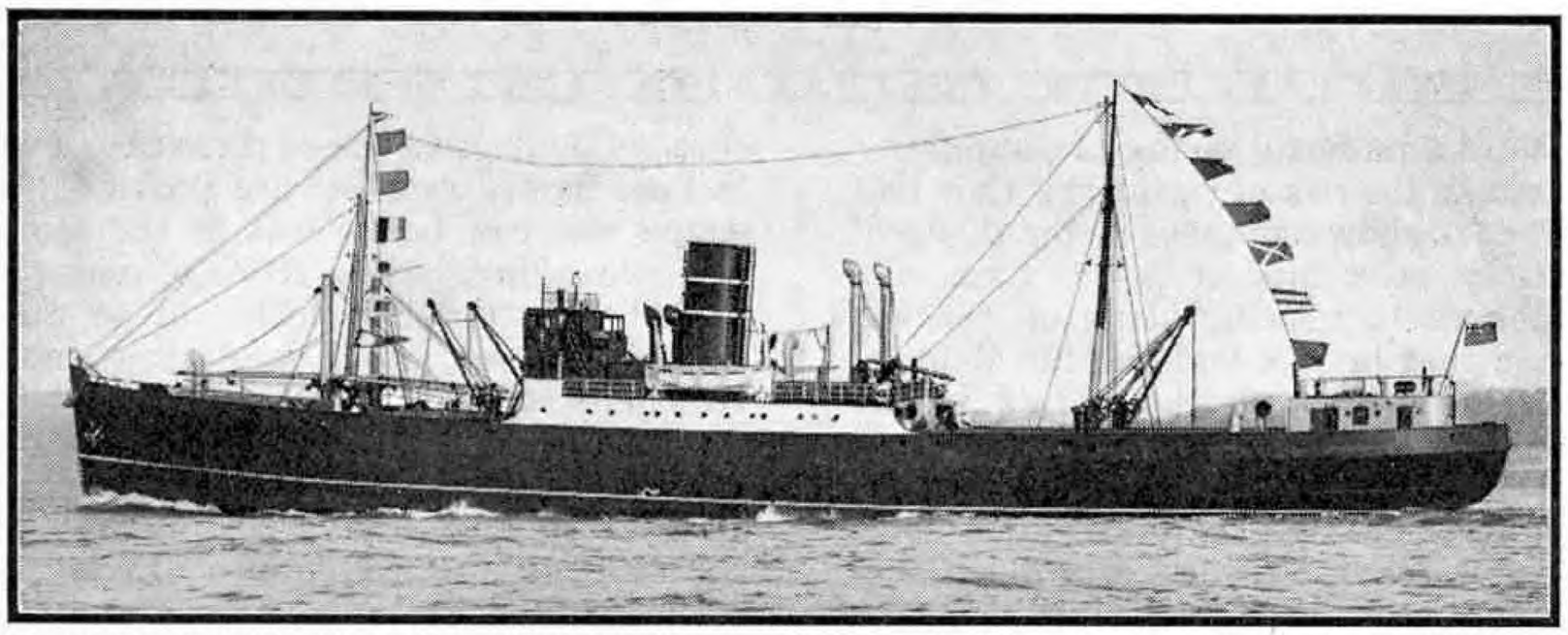
American Tanker Construction

The increasing popularity of the motor vessel has naturally resulted in a greater demand for oil fuel, and this in turn has necessitated the building of more tankers. There was a great increase in tanker construction in the United States during 1936, as compared with preceding years, and during the year 30 vessels of this kind were built or ordered, their combined gross tonnage being 230,000.

Interesting features were incorporated in several of these vessels, particularly in two built for the Gulf Oil Company. These were designed to carry several different grades of oil simultaneously in 16 main tanks and eight deck tanks, and therefore carry an unusual number of independent pumping units. Some of the largest tankers were built for the Pan-American Petroleum Company, and are 500 ft. long and 68 ft. wide, with a displacement of 21,500 tons. The cargo tanks have a capacity of 5½ million gallons.

An Interesting Coasting Steamship

The upper illustration on this page shows the single-screw steamship *"Aboyne,"* specially designed for the cattle and general cargo trade and built recently at Dundee by the Caledon Shipbuilding and Engineering Co. Ltd. for the Aberdeen, Newcastle and Hull Steam Co. Ltd. The length overall of the vessel is 259 ft., her beam is 37 ft. 6 in., and her gross tonnage 1,020. She is of the shelter deck type, with machinery amidships, and has a raked bar stem and cruiser stern. Her machinery consists of a single set of triple expansion engines of the most modern and improved design that develop 1,650 i.h.p. and give a service speed of about 13½ knots. Steam is generated by two single-ended cylindrical multi-tubular boilers, each 15 ft. by 12 ft. 6 in., and working at a pressure of 220 lb. per sq. in.



The coasting steamship "Aboyne," specially designed for the carriage of cattle, sheep and horses, and general cargo. Photograph by courtesy of the Caledon Shipbuilding and Engineering Co. Ltd., builders of the vessel.

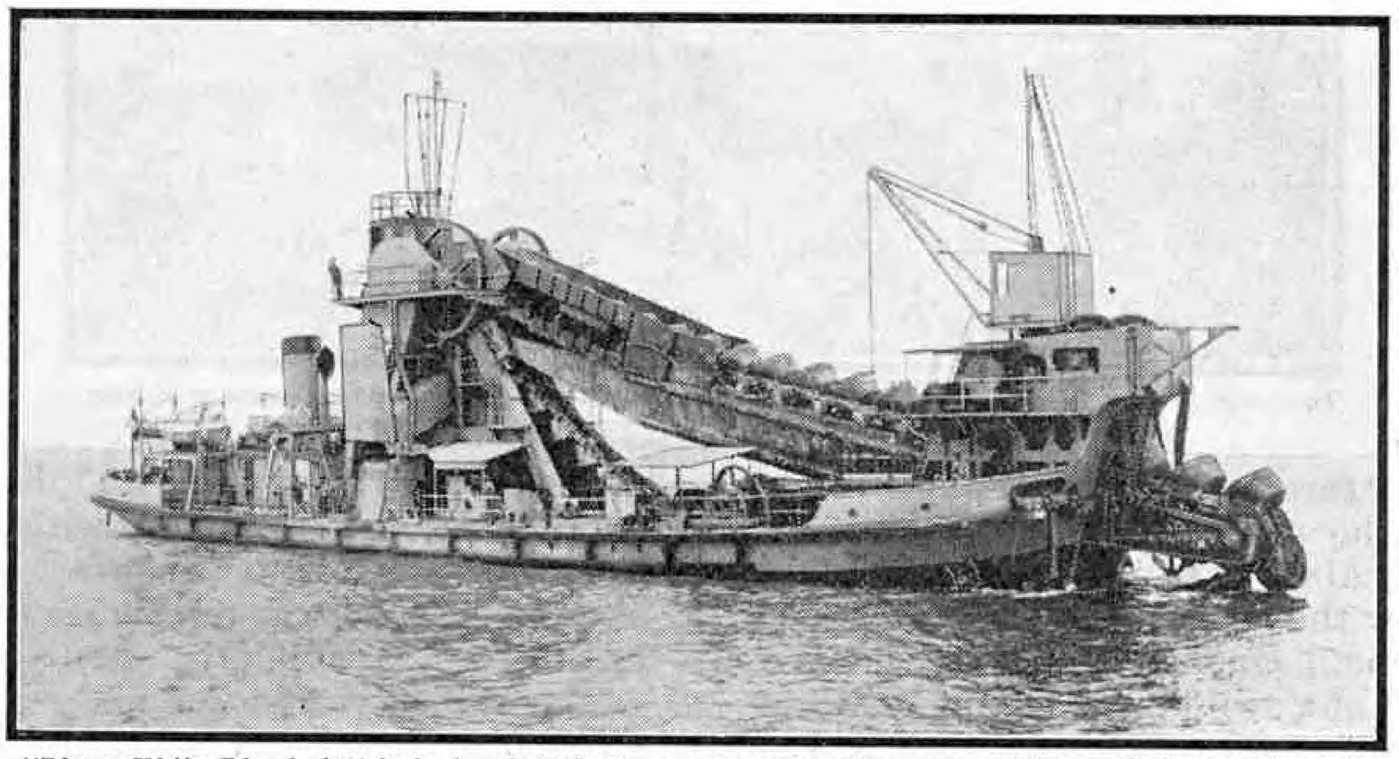
The ship has two holds for general cargo, and each has a platform deck so arranged that it can readily be removed if large clear holds are required. The continuous shelter between decks is occupied by stalls for the carriage of cattle, sheep, and horses, and there are large doors in the ship's sides for the cattle gangways. Cargo is handled by means of four 3-ton steam turntable cranes and six steel derricks. of which two are capable of lifting up to seven tons. The derricks are fitted with special traversing gear, and have separate slewing winches in addition to those provided for cargo lifts.

The accommodation for officers and engineers is in a large bridge house amidships, while the crew are housed on the upper deck aft.

Dredger with Diesel-electric Drive

The lower illustration shows the Diesel-electric bucket chain dredger *"Dieppe IV,"* the hundredth of her type built by the Forges et Chantiers de la Méditérannée. She commenced work in the Paris Dock at Dieppe after completing her trials at Havre. At Dieppe she immediately showed the value of her Diesel-electric drive. The bucket chain of the dredger previously in use there often broke because of the great height through which the line of buckets had to be raised, but the new dredger is fulfilling its work to the complete satisfaction of the authorities, in spite of the severe working conditions.

The *"Dieppe IV"* has a length of 172 ft., and a displacement tonnage of 1,200, and can dredge to a depth of 50 ft. She is fitted with an airless injection seven-cylinder two-cycle Diesel engine of 900 b.h.p., coupled to a direct current generator, the output of which is taken as desired to the two propulsion motors of the vessel, to the motor driving the dredging mechanism, or to the dredge winches and other auxiliaries. The driving motors are of 330 b.h.p. each, and are connected to the propellers through gearing that reduces the speed from 1,200 to 170 r.p.m. An auxiliary electric set of 50 kW, driven by a 3-cylinder Sulzer Diesel engine of 80 b.h.p., operates the auxiliaries when the main engine is not running.



"Dieppe IV," a Diesel-electric dredger built in France. Photograph by courtesy of Sulzer Bros. (London) Ltd.

New Ships for South African Trade

The Shaw, Savill and Albion Line recently placed an order for a 26,500-ton passenger liner to operate on the South African, Australian and New Zealand route, and are now having another cargo passenger liner built for the same service. This vessel will be of 11,000 tons gross, and will cost about £4,000. She will have an overall length of 535 ft. 6 in., a beam of 70 ft. and a draught of 43 ft. 4½ in. An important feature of her design is the provision of space for 1,000 tons of chilled beef, traffic in which has recently increased considerably. The vessel is being built by Harland and Wolff Ltd., and will be completed next summer.

There has been a considerable increase in the first half of this year in orders for vessels to operate on South African services. A motor vessel for the Silver Line will be of about 7,000 tons gross and will have a service of 15 knots. The largest order of this kind placed recently was that of a Norwegian company for five fast cargo motor ships to run between Canada and South Africa, and another Norwegian vessel designed for the Union trade is the express motor cargo liner *"Titania."*

More Life-boats to be Fitted with Wireless

The Royal National Life-Boat Institution has made use of wireless in boats of its fleet for some 10 years, and up to the present 18 life-boats have been equipped with radio telephony and one with wireless telegraphy. Following recent improvements in radio telephony apparatus, the Institution has now decided to install wireless equipment in 14 other life-boats. The equipment will be capable of receiving and sending messages over a distance of at least 50 miles. It also can be used in the boathouses. So far this has been impossible in many cases, for the aerial had to be dismantled on landing.

Of the 14 life-boats to be fitted with wireless, five are in England, stationed at Sunderland, on the Humber, and at Clacton-on-Sea, Margate, and Penby, and six are in Scotland, at Longhope, Stromness, Wick, Thurso, Aberdeen and Broughty Bay. Of the remainder, two are stationed at Fishguard and St. David's in Wales and one at St. Mary's, in the Scilly Isles.

The fleet of the Institution now consists of some 173 motor life-boats and about 35 pulling and sailing craft. The latter are steadily being replaced, and recently three of them, stationed at Kilmore, Cullercoats and Blackpool respectively, have given way to motor craft.

The three new boats are all of the light Liverpool type, having a length of 35 ft. 6 in., a beam of 10 ft. and a weight of 7 tons. Boats of this type are divided into six watertight compartments and fitted with 115 air-cases, and are able to free themselves from water, if seas break aboard, in 12 sec. A 35 h.p. engine fitted in a watertight engine-room gives a speed of 7⅛ knots, with a range of 100 miles at full speed without refuelling. A crew of seven is carried and accommodation is provided for 30 people in rough weather. Boats of the light Liverpool type cost £3,500 to build.

World's Largest Welded Vessel

A giant new tanker under construction in America for the Atlantic Refining Company will be the largest welded vessel in the world. In addition she will be the largest merchant ship built in America.

The vessel will have a length of 521 ft. b.p., a beam of 70 ft. and a deadweight tonnage of 18,500. Her capacity will be 156,000 bulk barrels of petrol. Turbo-electric machinery developing 5,000 h.p. will give her a speed of over 13 knots, and she will be able to make the passage between Philadelphia and Gulf ports in 6 days.

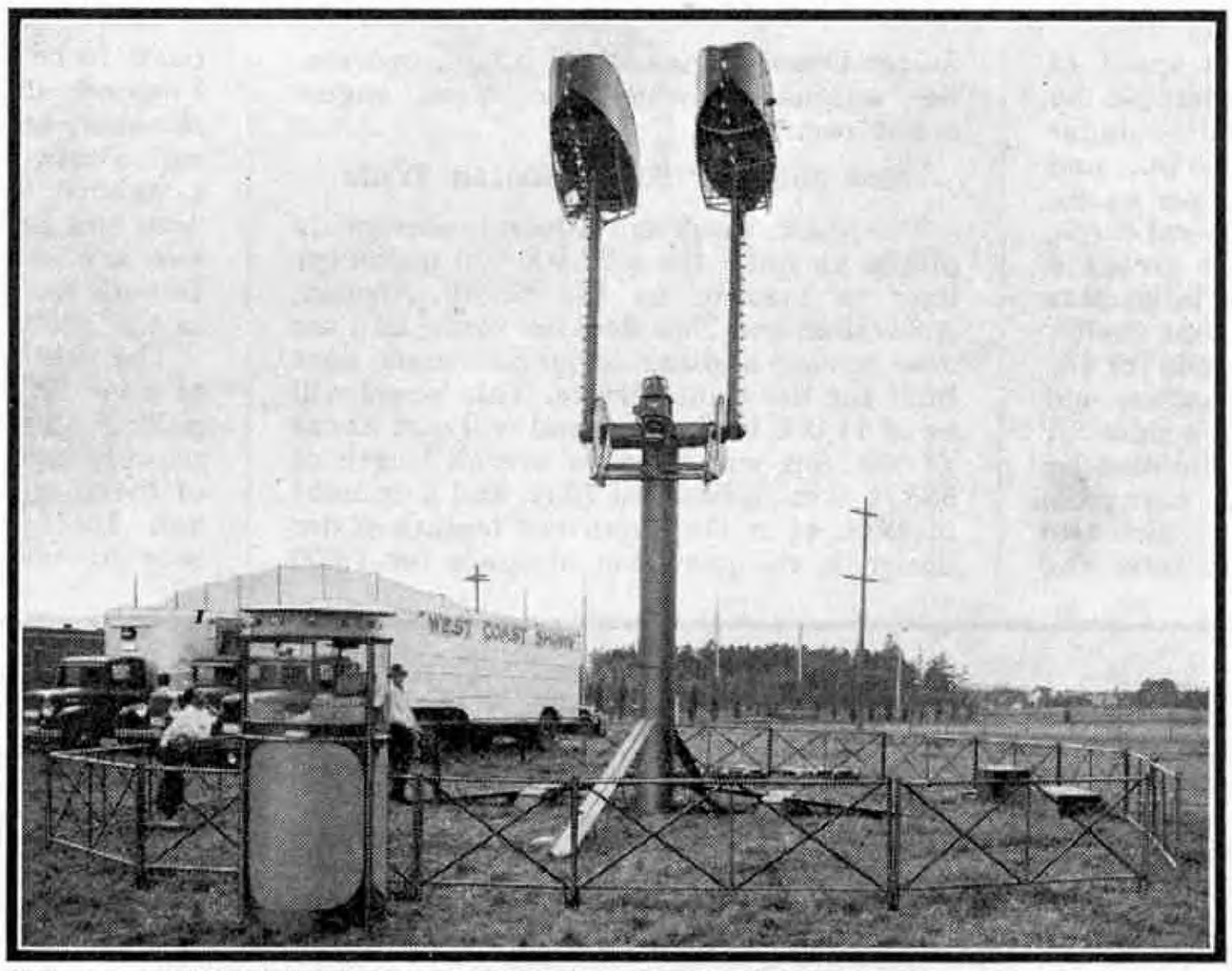
The Engineer in the Amusement Park

Modern Mechanical Thrills

By Wm. A. Bagley

FEW people can afford a powerful racing car, and fewer still would care to take the risk of racing it if they had one. The amusement park showman gives us the thrills of speed in perfect safety at a modest price. Even the most hard-boiled modern boy racing along on the Big Dipper might imagine that he is a budding Sir Malcolm Campbell, or that he is flying over the watery wastes of the Atlantic as he is swung round in a miniature airplane at the end of a cable.

The elaborate amusement parks that have come into being at Blackpool, Rhyl, Skegness and most large resorts are far different from the shabby travelling fairs that pitch at any available patch of waste ground. Large sums are expended on the machinery employed in them, and behind all their noise and bustle is the engineer, without whose technical skill the various "rides" would not be possible. The devices in them are not slightly constructed, just because they are used for somewhat frivolous purposes. On the contrary, there is as much skill put into the making of a modern switchback as there is in making a new bridge or other engineering job. Because of this skill, and the showman's constant vigilance, accidents due to mechanical fault are very rare, and the chief danger comes from the excited fool who wishes to "show off."



The Loop-O-Plane, in which passengers securely strapped in their seats are swung round in a circle. This is a sensational amusement park novelty from the United States.

The Blackpool switchback, which has just been reconstructed and is now the largest in Europe, is a good example of the amusement engineer's skill. In pre-war days the greatest height of a switchback of this kind was about 40 ft., and a speed of 30 m.p.h. was regarded as thrilling. The highest point of the new track is 72 ft. above the ground, and a speed of 72 m.p.h. is reached on it. There are six trains of three cars, every one carrying 18 passengers. Each car has 12 wheels, four to carry the weight of the passengers, four for guiding, and four for safety, and two trains run simultaneously on separate tracks. The cars are linked by universal spring couplings, and weigh five tons fully loaded.

There is an impression that the momentum derived by running down the inclines tides the trains over the uphill bits. This is not always possible. In reality the gradients are provided with hoisting cables moving at exactly the same speed as the trains, and a train is automatically coupled by dogs to one of these cables when it runs up an incline. Safety ratchets are provided, so that the train would not run backwards in the remote event of the chain breaking, or the 100 h.p. motor stopping.

The most familiar "ride" in an amusement park is the roundabout, which is of some antiquity. In successive generations it has been worked by men, animals, steam and petrol engines, electric motors and now Diesel engines, and has grown from the childish "Merry-Go-Round" to huge affairs costing well over £5,000 each. In one form, the well-known "Flying Boats," the boats are first raised 40 ft. above the ground by a 15 h.p. motor and horizontal rotation is then effected by a 26 h.p. motor suitably geared down. In another type, the boats are not raised like lifts, but are swung outwards under centrifugal force. The cables, about 50 ft. long, have a permissible load of 1,100 lb., and the boats describe a circle about 140 ft. in circumference.

One of the most popular "rides" to-day is the noisy "Auto-Skooter" with the terrific bumping and head-on collisions. One can imagine how strong the cars used in this have to be. They are generally made of steel and hardwood. The method by which overhead wire netting is used as one pole and the metal floor as another, in order to supply the motor with current, is plain even to those whose knowledge of electricity is slight. What is not always realised is the terrific load the electrical apparatus has to bear, particularly when there is a jam.

The skilled electrician plays a great part in modern amusements, and an example of the difficulties he has to face is given by the device called the "Watershoot," in which boats have first to be raised by means of an electric lift. The current at the start increases from the normal value of 4.8 amp. up to 60 amp.

The electric boat provides another example. At one pool the writer visited, there were 30 boats, each containing a 6.25 h.p. electric motor running at 1,200 r.p.m. The speed of the boats was upwards of six miles an hour, and the centre of gravity was made so low that the boats could not capsize. An innovation was that the current did not come from overhead wire netting "earthed" to the water. The process was reversed, the wire netting being the negative pole. Four tons of

salt was dissolved in the water, and one could place one's hand in the water and feel nothing.

A peep behind the scenes revealed electric apparatus larger than one would suspect. A three-phase Partridge Wilson rectifier and transformer converted alternating current at 400 to direct current at 100 volts, and there were two valves to each phase.

Power for these amusement devices is all-important, and is required to give the bright lighting that helps to attract the crowd as well as the power needed to work the devices. The permanent amusement parks have their own power stations, and the familiar steam engine that generated power for travelling shows is being replaced by the Diesel engine. One showman built several large trucks, each containing a six-cylinder 125 h.p. Diesel engine driving alternators. Within the truck he had a collapsible steel and aluminium tower, containing a ton of floodlights.



The "Grand National" switchback at Blackpool in the making. Speeds of 72 m.p.h. are reached with safety on it.

One of the largest "rides" ever built was the "Skyride" at the Century of Progress World's Fair held at Chicago a few years ago. It was not strictly speaking an amusement device of the usual kind, for it did not seek to "rough up" passengers. It aimed rather at giving them the thrill similar to that of travelling by airship, for the cars in which they rode were suspended more than 200 ft. above Lake Michigan from a set of cables hung between two tall pylons each 628 ft. high and 1,830 ft. apart. The idea was to give passengers a wonderful view of the Exhibition, and in five months three million passengers made the trip without mishap.

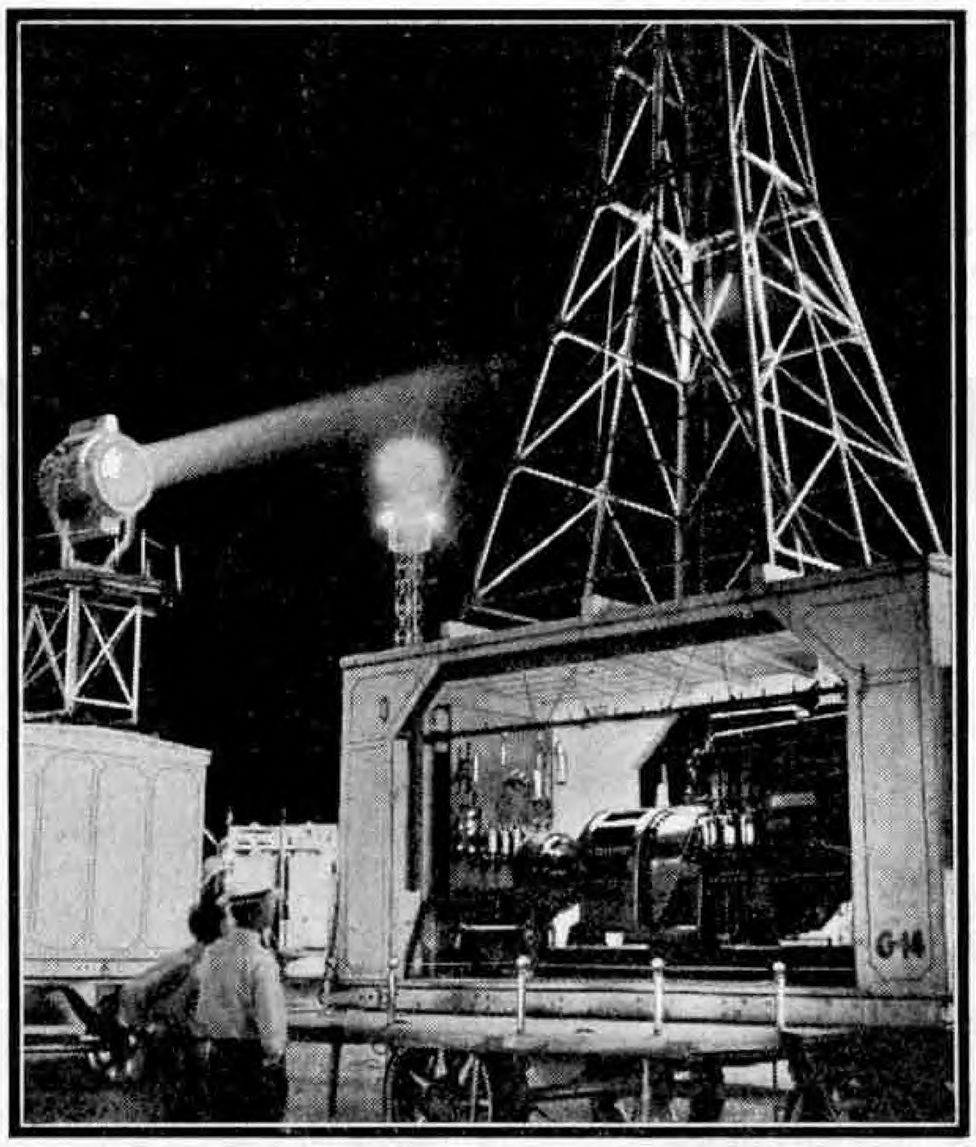
The construction of the "Skyride" aroused great interest in the welding industry, as novel methods were used. The device was in effect a great transporter bridge. The main towers had bases 110 ft. square and each was provided with an observatory at the top with the regular loading platforms a little less than half-way up. There were four fast lifts in each tower. The entire truss system consisted of wire ropes integral with the main cables, and not the conventional form of structural steel stiffening trusses.

Each of the 10 cars held 36 passengers, who sat back on a double deck, and was independently controlled. It was suspended from an eight-wheeled trolley running on a set of eight track ropes, in two sets of four. The four outer wheels were for support, whilst the inner wheels, specially grooved to grip the hauling rope, were driven by motors in the car when rounding the curve of the platform in order to make the return journey. The speed attained was about 6 m.p.h.

In all, about 2,000 tons of structural materials were used in building the "Skyride," in which there were 1,000 tons of cable.

New "rides" are rare, and the United States and the Continent are eagerly scoured for any novelties. Before a new machine is put into operation, a sample one is tested almost to destruction, with loads greatly in excess of any it will be called upon to bear in actual use. Everything is made quite six times as strong as necessary, for the engineer has to take into consideration that the fair-ground mechanics are not always so skilful as he would wish, and so takes no risks, making his machines as foolproof as possible.

A sensational new ride known as the "Loop-O-Plane" comes from America. In this the passenger, strapped in a seat, is whirled round in a giant loop 32 ft. diameter. The arm swings slowly upward, and is then allowed to drop, thus giving the sensation of a steep dive to the ground. It looks dangerous, but is quite safe, and venturesome passengers experience all the thrills of "looping the loop" in perfect safety. There are two models, one with a single arm that takes four adults, and another with a double arm, taking 12 adults or 16 boys and girls.



Diesel engines in the amusement park. The lorries carrying these power plants also support floodlighting towers. Photograph by courtesy of the Caterpillar Tractor Co., Peoria.

Some of the machinery in an amusement park is almost as great an attraction as the rides themselves. The Diesel engines installed on specially equipped lorries that are shown in the lower illustration on this page usually are surrounded by visitors, who eagerly examine the machinery and admire the skill with which it is adapted to its work. These lorries serve a double purpose, for they also supported the towers carrying the great floodlights that illuminate the fairgrounds in which they are used. Most of the rides themselves are equally worthy of examination as examples of sound engineering, with an ample margin of safety. Every feature is carefully worked out in advance with the aid of models, in the construction of which extensive use is made of Meccano parts.

A Pioneer of British Electric Railways

The Career of Magnus Volk

THE pioneer of electric railways in Great Britain was Mr. Magnus Volk, who died recently at his home in Brighton. Mr. Volk was 86 years of age, and his chief claim to fame was the construction as early as 1883 of the electric railway along the sea front at Brighton, the first in Great Britain. Mr. Volk also was a pioneer in electric lighting, for before 1880 he lighted his own house with electricity, long before this came into general use; and in addition he erected the original telephone plant in Brighton, Hove and other Sussex towns, and built and ran one of the earliest electric motor cars.



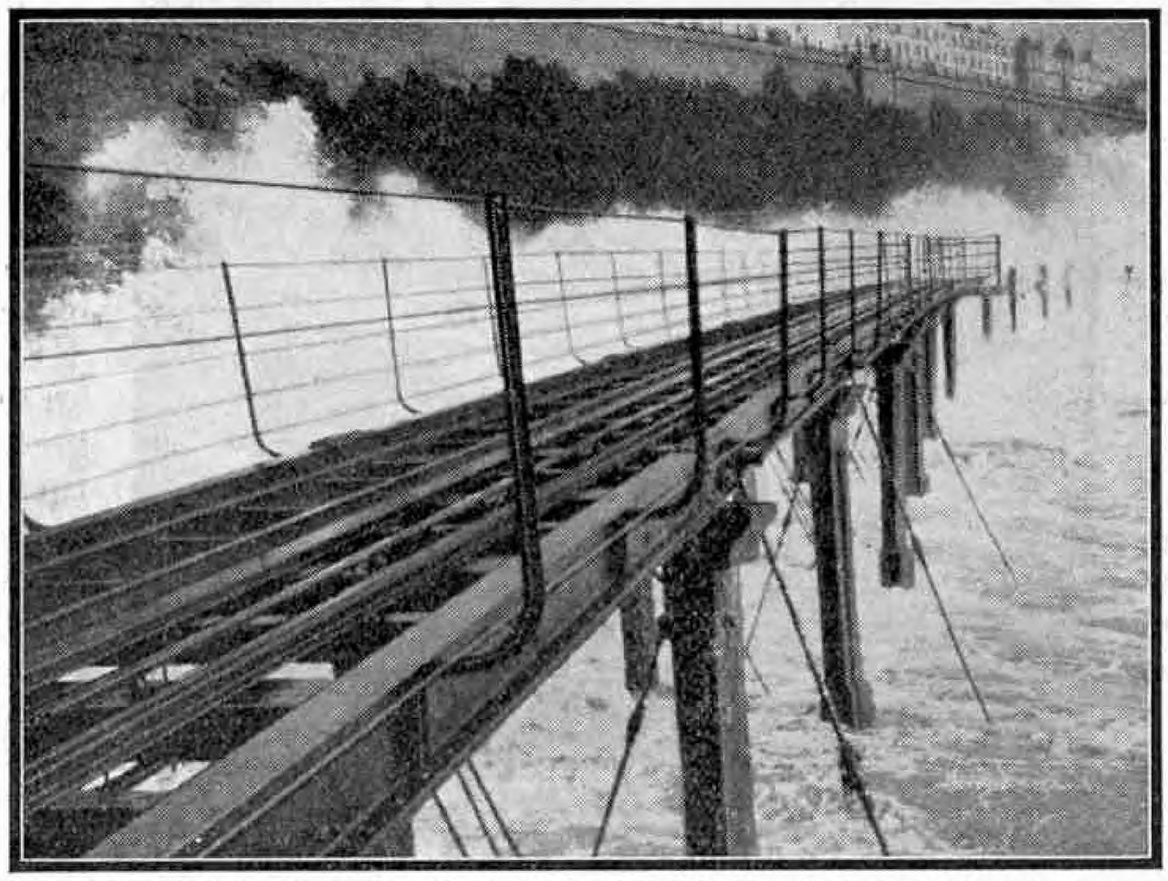
An electric railway, designed and built by Magnus Volk, which for a time ran through the sea at Brighton. The illustrations to this article are reproduced by courtesy of Magnus Volk Ltd.

It is interesting now to recall the outstanding features of Mr. Volk's career, and the story of his construction of the first electric railway in this country. He was born in 1851 in Brighton, where his father had a clock-making business, and at an early age showed great ingenuity in building models, making windmills and steamers out of old clocks as soon as he was able to use a few tools. His inventiveness earned for him the name of "Magnus the Dreamer" at this time, and as he grew older he dreamed to good purpose, for he was one of the men who led us into the electric age in which we live.

Mr. Volk was only 14 years old when his father died, but the boy took over the clockmaking business. Then he began to make toy telegraph instruments, and became sufficiently prosperous to employ 20 workpeople. Later he added electric bells and shocking coils to his range, and it was soon after this that he became interested in electric lighting. This led to his appointment as electrical engineer to the Corporation of Brighton, and in 1883 he lighted the Royal Pavilion estate electrically. This installation was then the largest of its kind in the country. A large chandelier in the Dome of the Pavilion was wired for 200 lamps, which had carbon filaments, and the 200 gas fittings in it were retained for possible use in emergency. This made Mr. Volk's work more difficult, for his insulating materials had to be capable of withstanding the heat of the gas flames.

In the meantime he had begun to plan the electric railway that was to make him famous. He had made an electric motor for a London firm, which had not accepted it, and with this, a small Siemens dynamo and a 2 h.p. gas engine he carried out some experiments that suggested the great idea to him. He asked the Brighton Corporation for permission to build an experimental line along the sea front, and when this was granted he set to work. His track, of 2 ft. gauge, was made of flat bottomed rails spiked to longitudinal sleepers, with shingle packing, and his first car was a crude one with four wheels. The gas engine and dynamo were installed in a tiny power station under an arch in the roadway opposite the Aquarium. Current was generated at about 50 volts, and was conducted to the motor by means of the wheels.

The line was laid and the equipment prepared in the astonishingly short time of 18 days. The track ran from the Aquarium to the Chain Pier, so that it was only about a quarter of a mile in length, and it was opened on 3rd August, 1883. The greatest interest was taken in the event, for there had been many gloomy predictions that it would prove to be a complete failure, and probably many of those in the crowd that assembled for the opening hoped to see something sensational. In this they were disappointed, however, for the car started without a hitch as soon as power was switched on by the Mayor of Brighton, who drove it on this occasion, Mr. Volk acting as conductor.

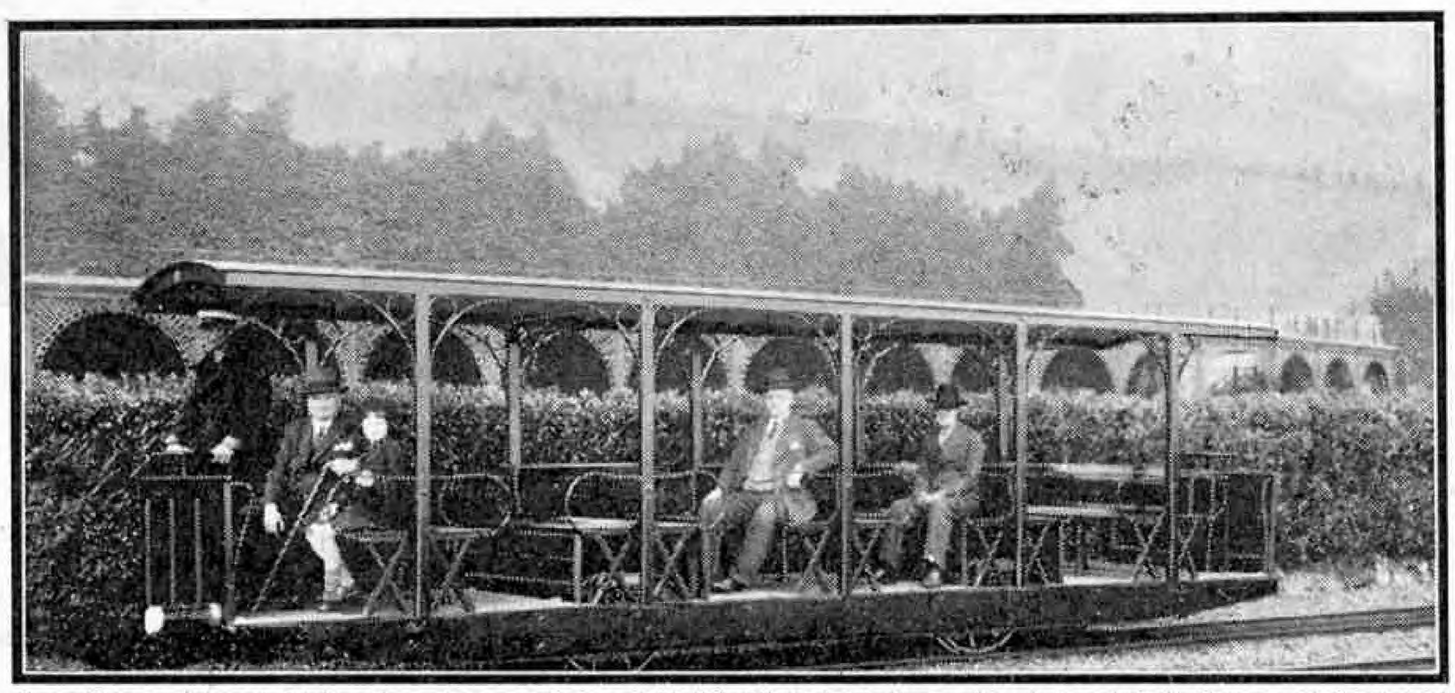


Waves breaking over a portion of the track of Volk's Electric Railway during a storm.

From that time the line was very popular, in spite of the forebodings of a few obstinate people who saw in it the latest invention of the Devil. About a thousand passengers enjoyed the novelty of a trip on it on August Bank Holiday of that year, when the railway was in operation

for 11 hrs. and the little car ran about 50 miles at its regular speed of 6 m.p.h. From then until the end of the year about 300,000 passengers were carried, and the enterprise was so successful that the period for which permission to operate it had been given was extended, and the line was lengthened to Paston Place, and subsequently to Black Rock.

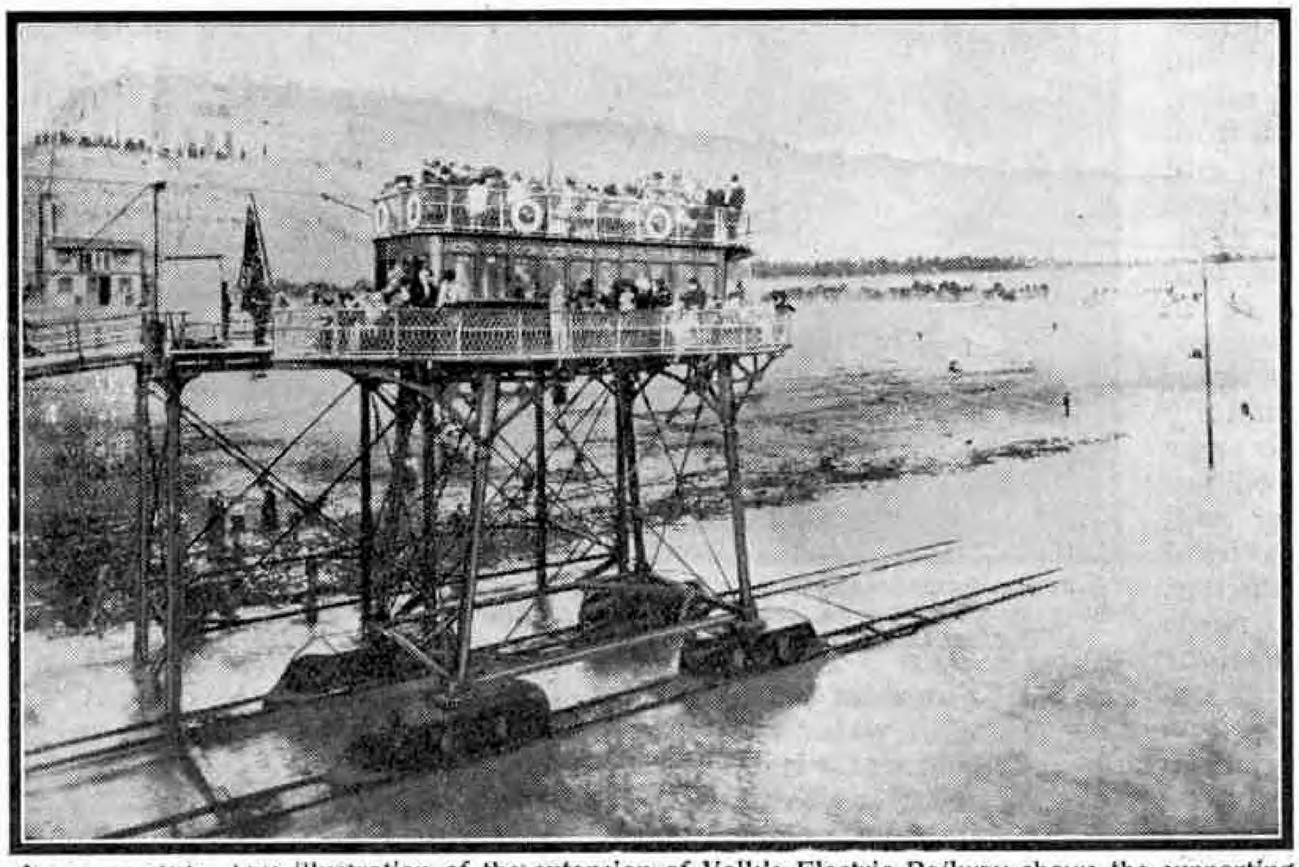
Then followed a great struggle. Violent storms wrecked the line four times during one summer, and sleepers, boards and other equipment disappeared from time to time, removed possibly by cabmen, boatmen, and hay and corn dealers who thought the railway threatened their livelihood. Mr. Volk fought pluckily against misfortunes of all kinds, however, and he received so much support locally that he was able to keep his line open and to retain complete control of it. On one occasion a stranger offered to provide him with capital without any legal agreement, and on another a local newspaper raised a fund by subscription to enable the whole line to be repaired.



One of the cars used during the summer season on Volk's Electric Railway. In winter closed saloons are employed and there is a five-minute service throughout the year.

To-day the track is of 2 ft. 8½ in. gauge, the only one of this measure in Great Britain, and has rails of normal shape laid down on sleepers across the track. The third rail system is used for supplying current to the motors of the cars, and a 90 h.p. motor generator converts the Corporation mains supply to the direct current of 160 volts required. It is interesting to find that Mr. Volk's original generator was still in use as a motor on one of the cars as late as 1934, 53 years after the line was opened.

In places Volk's Electric Railway runs over the sea, and one of our illustrations shows rough seas breaking over the track. The inventor built another electric railway that went not over, but actually through the sea. This was intended to serve as an extension of his original electric railway from Paston Place to Rottingdean, and the track was laid on the shore, where it was submerged at high tide. There were really two tracks each of 2 ft. 8½ in. gauge, and they were laid down parallel to each other and 18 ft. apart, on concrete blocks.



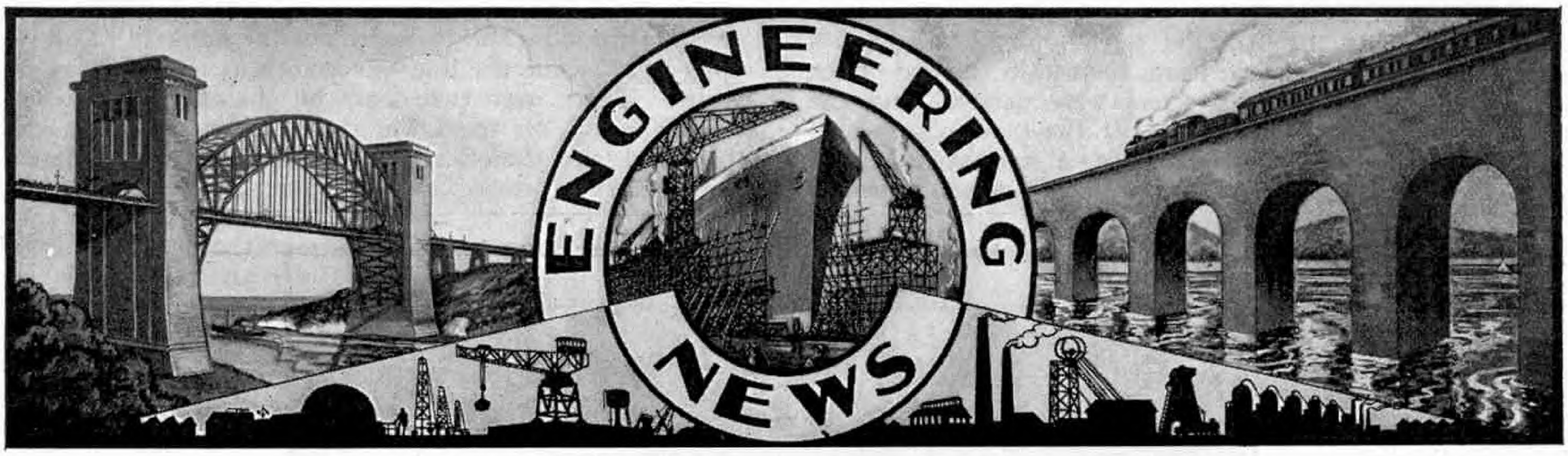
A car on stilts. This illustration of the extension of Volk's Electric Railway shows the supporting columns of the car and the four-wheeled bogies running on the double track.

The car of this novel railway was built on four steel tubular legs, each about 24 ft. high and 1 ft. in diameter, that were supported on four-wheeled bogies. They kept the car clear of the water, whatever the state of the tide, and earned for it the name of "Daddy-long-legs," while the line was known as the "railway on stilts." There were two decks on the car, with an enclosed saloon on the lower deck surrounded by a rail platform, and the effect of being at sea was heightened by a generous provision of lifebuoys, and by the presence of a lifeboat that the Corporation insisted should be carried. The line was 2¾ miles long and at high tide the car travelled through water to a depth of 15 ft.

The overhead trolley system was used for this railway in the sea, and current at 500 volts, generated on the pier at Rottingdean, was supplied to the four 25 h.p. motors of the car, one for each bogie. The drive was transmitted to the wheels by means of bevel gearing and shafts passing down the tubular legs of the car.

The line was opened in September 1896, and for a short time fulfilled its purpose of giving visitors to Brighton an impressive view of the cliffs. Unfortunately the sensation of travelling in a railway at sea was not enjoyed long, for the line was damaged by a gale. It was repaired and reopened, but eventually a stop had to be put to working and the track was taken up. No such railway had ever previously been built and the experiment has not been repeated, but there seems no reason why a railway of this type should not be successful, and better results probably would have been attained if more money had been available for improving the car and track. In its place the original Volk electric railway was extended to Black Rock, the new line being opened on 21st February, 1901.

Besides being a pioneer of electric lighting and electric railways, Mr. Volk was an early motor car inventor, and in 1887 he drove an electric car, believed to be the first ever used, on the Parade at Brighton. This car achieved unexpected fame in a far distant country, for the Sultan of Turkey is said to have heard of it through a report in a German newspaper. The result was that Mr. Volk was invited to make another one for the Sultan, and did so, taking it to Constantinople himself in order to show its capabilities. At an earlier date he designed magazines for rifles, and afterwards was concerned in the development of torpedoes and mines used for defending the approaches to ports.



The World's Greatest Aqueduct

In order to increase its supply of water, the City of New York has decided to start work on one of the largest construction projects ever undertaken. This will involve the building of three great reservoirs in the Catskill Mountains and the boring of an 85-mile tunnel, entirely in rock, to deliver the water from the reservoirs to the city limits. This will be by far the longest tunnel in existence, and together with the reservoirs will cost over £54,000,000.

Throughout the route of the 85-mile main tunnel, which will be known as the Delaware Aqueduct, drillings have been made at short intervals in order to determine the depth that will have to be attained to ensure that the tunnel keeps well in the solid rock. It is intended to allow a minimum cover of 150 ft. of rock. The tunnel will be circular in section and will be lined with concrete averaging 2 ft. in thickness. The first part of the tunnel will have a finished diameter of 13½ ft., and this will increase to 19½ ft. as the tunnel nears the city boundaries.

Access shafts to the tunnel will be sunk at intervals of about 3½ miles. These shafts will range in depth from 310 to 1,550 ft., and the largest will be elliptical in shape and will have dimensions of 32 ft. 2 in. by 22 ft. The remainder will be circular, and will vary in diameter from 14 to 19½ ft.

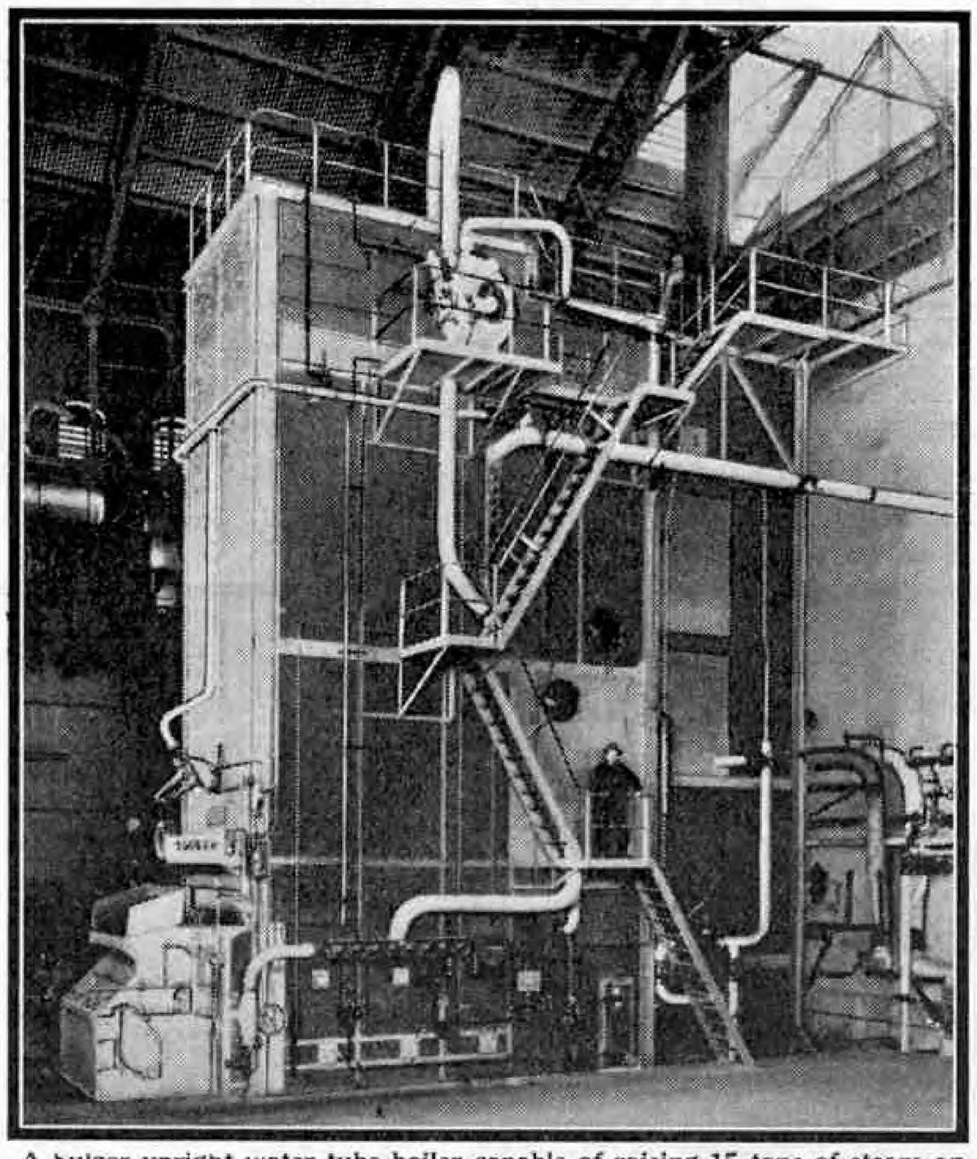
The existing New York City water supply system has cost approximately £117,000,000, and when the new facilities now to be constructed are completed the capital outlay will have reached the stupendous total of £171,000,000, a sum sufficient to build 10 great concrete roads across the United States, or eight Boulder Dams each complete with its own power plant! This is the largest amount ever spent at one time by a city in developing its water supply system.

£700,000 Waterway In China

A new canal that has cost about £700,000, has recently been completed in China. It has taken two and a half years to construct and its length of over 90 miles makes it the largest artificial waterway in the country. It stretches across North Kiangsu from Hungtze Lake, on the Kiangsu-Honan border, to the sea. In addition to providing a much-needed outlet to the sea for interior produce, it will act as a drainage system for the surrounding country during the rainy season, and so will help to prevent the many disastrous floods that have troubled this district in the past.

Fine Modern Boiler for Chinese Power Station

The illustration on this page shows a Sulzer upright water tube boiler that has been installed recently in the power station of the Tientsin Electricity Supply Company, China. The boiler is of the latest design and is capable of raising 15 tons of steam an hour at a pressure of 425 lb. per sq. in.



A Sulzer upright water tube boiler capable of raising 15 tons of steam an hour at 425 lb. per sq. in. pressure. It is installed in the power station at Tientsin, China. Photograph by courtesy of Sulzer Bros. (London) Ltd.

The sides of the furnace chamber are lined with water cooling tubes, through which cold water is circulated to prevent the walls becoming overheated, and the fuel is fed to the furnace by a travelling stoker. Forced draught fans and special means of preheating the air fed to the combustion chamber are features of the auxiliary equipment of the boiler, which includes also apparatus for testing the temperature of the exhaust gases in the flues.

New Canadian Empire Broadcasting Station

The Canadian Broadcasting Corporation intends to establish a high-powered short-wave radio transmitting station that will be sufficiently powerful to link Canada with all other parts of the British Empire by radio. The station will have a power of 50 kilowatts.

The Smallest Ball Bearing

The engineering industry is well provided with all kinds of ball and roller bearings, varying in size between 5 ft. and ½" external diameter. There are, however, many small mechanisms, such as watches, recording meters, speed indicators, and scientific instruments that at present use plain or jewel bearings in their construction owing to the fact that miniature ball bearings of suitable size have not been available at reasonable prices. A well-known Swiss watch manufacturer has now developed and manufactured on a commercial scale ball bearings so small that they can be substituted for ruby, sapphire and plain bearings in all forms of clockwork motors, delicate machines and sensitive measuring instruments. These miniature ball bearings are now being produced in quantity to standards of extreme precision, although the overall size of a complete bearing, including the race, is less than that of an ordinary pin head! The overall dimensions actually range from 1.5 m.m. upwards, and in the near future complete bearings of only 1 m.m. overall size will become available!

The smallest of these miniature bearings contain three balls, but the largest have eight, and their bore is machined to an accuracy of a thousandth of an inch. Ball bearings of this type use less than one sixth of the oil required for plain bearings and, therefore, need not be lubricated for years. When correctly mounted the wear is negligible, even after a long period of use, and they withstand shock far better than jewel bearings. This is a feature of great importance, especially for aircraft instruments.

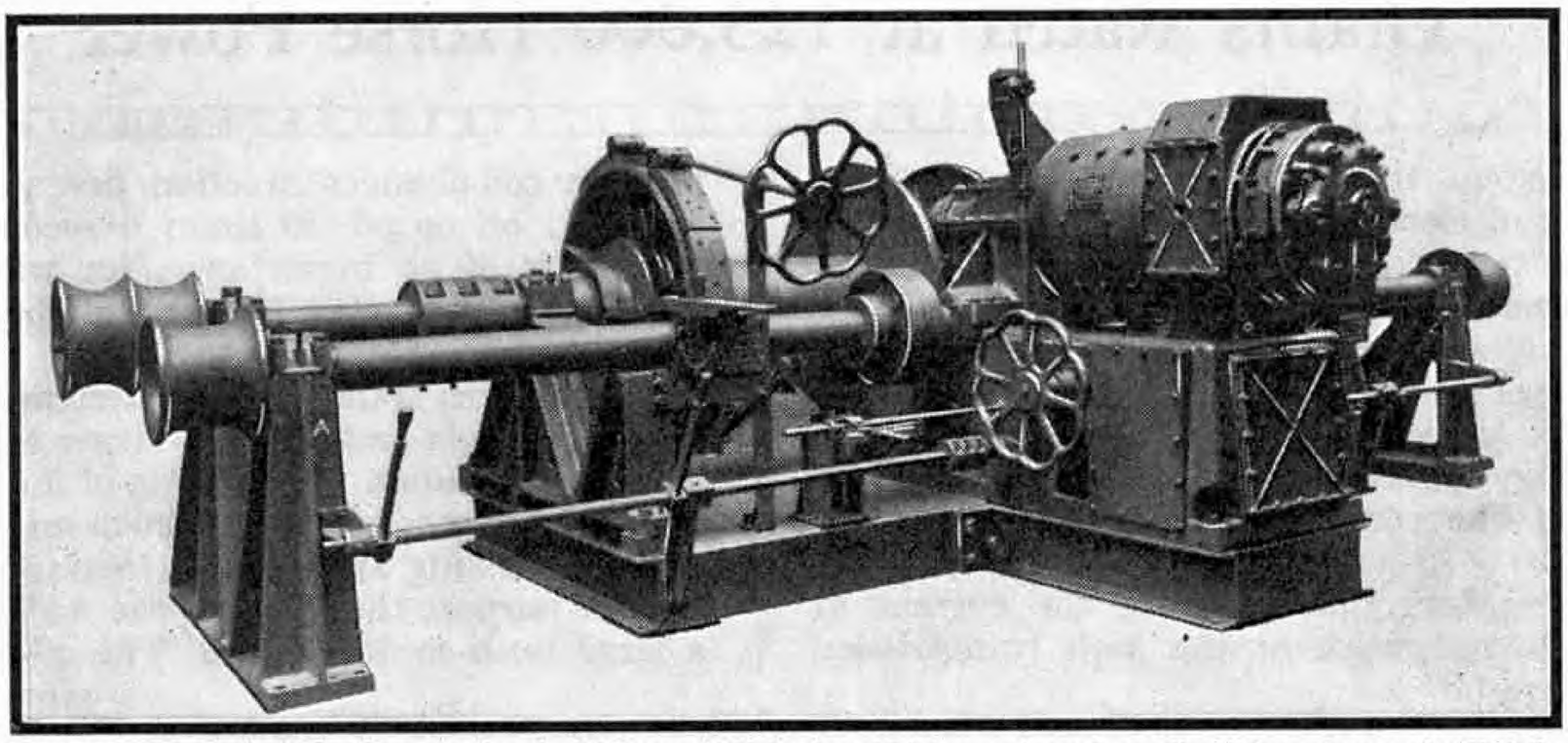
These miniature ball bearings are the invention and production of Roulements à Billes Miniatures S.A. of Switzerland, who are represented in this country by International Technical Developments Ltd.

Safety Device for Pressure System

An American firm has developed an ingenious device called a "safety head" for the purpose of protecting pressure systems in the same manner as fuses protect electrical circuits. The safety head consists of a set of special flanges that can be fitted to pressure vessels. Between these flanges is clamped a diaphragm of such a design that it will burst and relieve the pressure in the pipe lines at any predetermined safety limit. The device should prove valuable in many branches of engineering.

Powerful Electric Winch for Trawls

A large electrically-driven winch designed specially for hauling trawl nets is shown in the upper illustration on this page. It was constructed by Laurence, Scott and Electromotors Ltd., Norwich, and forms part of the deck equipment of the motor trawler *"Minerva."* The winch is 23 ft. 8 in. wide over the bollards and 12 ft. 5 in. long fore and aft. It is capable of developing 97 brake horse-power at normal full load, and exerts a pull of 7 tons at a speed of 156 ft. per minute.



An electric trawl winch for the motor trawler "Minerva." It develops 97 b.h.p. and exerts a pull of 7 tons at a speed of 156 ft. per minute. Photograph by courtesy of Laurence, Scott and Electromotors Ltd., Norwich.

The motor is arranged on the centre line of the winch, and is connected to the barrel shaft through worm and spur gearing. The worm gearing is enclosed in a watertight case, which forms part of the motor. Each winding barrel has a capacity of 762 fathoms of $\frac{7}{8}$" diameter wire, and is fitted with cast-steel clutches so that it can be disconnected from the shaft while the warp is being paid out. The bollards are fitted with band brakes, which are lined with wood blocks and are applied by hand-operated screw gear from the rear of the winch. The coiling gear, which can be disconnected when paying out the warp, runs along the forward side of the winch, and is operated through a rack and pinion from hand wheels at the operating side.

The winch is controlled by a deck hand operating a series of hand levers on a shaft that runs along its full length. To guard against damage due to careless handling a master controller is located in the deck-house, where it is under the eye of one of the ship's officers, and is geared to the control shaft on the winch by a rack and pinion.

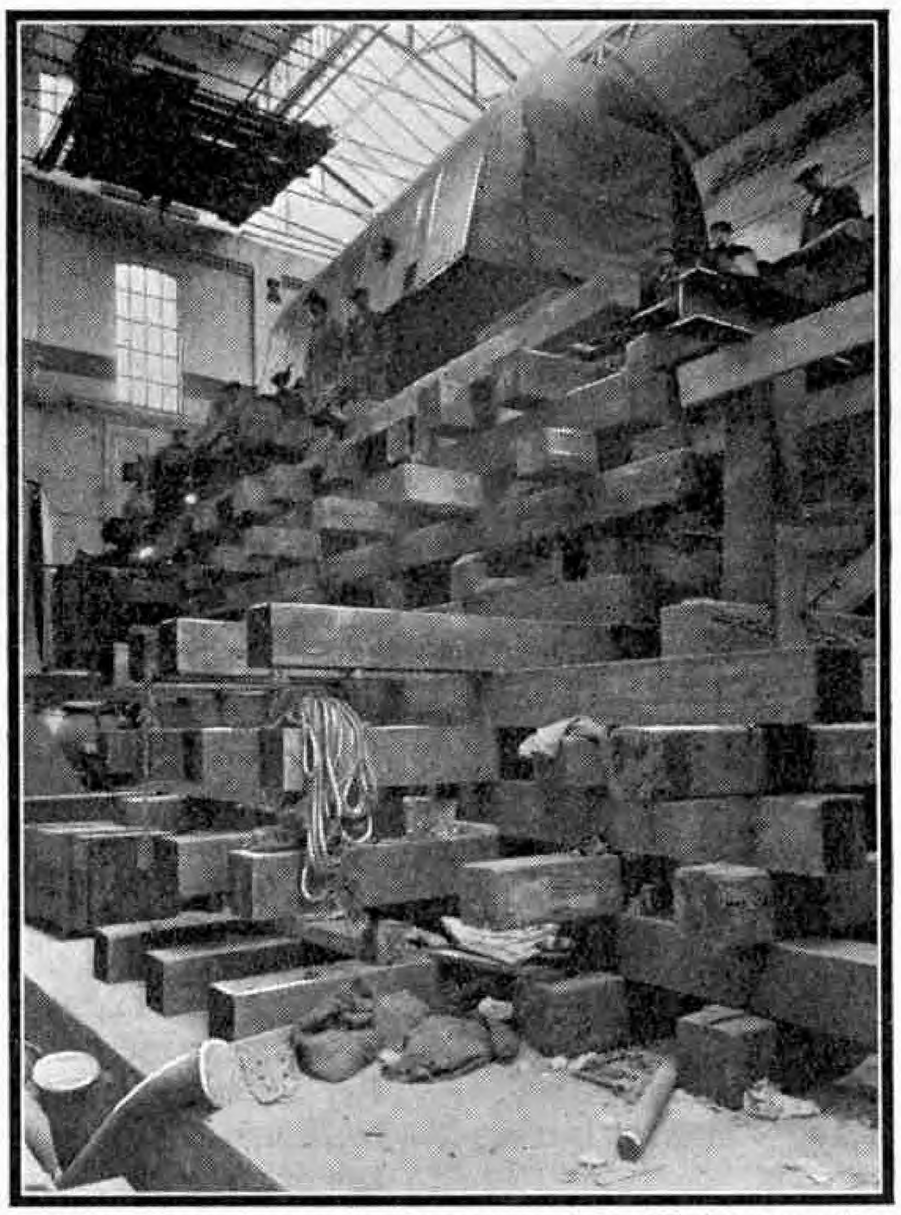
A Remarkable Erection Job

The lower illustration on this page shows a stage during the erection of a giant 37,500 kVA generator at the Brimsdown Power Station of the North Metropolitan Electric Power Company recently.

The generator, together with the turbine that is to drive it, was built at Trafford Park, Manchester, by the Metropolitan-Vickers Electrical Company, and owing to its huge bulk its transport to Brimsdown and its subsequent erection involved considerable difficulties. At the Metropolitan-Vickers works the stator, which weighs 82 tons, was lifted by two 50-ton cranes and loaded upon a special low truck of the London and North Eastern Railway Company. The journey was made under special arrangements during a week-end, in order to avoid interference with ordinary traffic.

At the siding at Brimsdown the stator was transferred by hydraulic jacks to a 100-ton road wagon, fitted with four axles and 32 rubber-tyred wheels, that carried it to its site in the power station, a distance of about 400 yards.

At the power station it was necessary to lift the generator to a height of 18 feet above ground level in order to mount it in its position near the turbine. This task was accomplished by raising the machine in small stages by means of four powerful hydraulic jacks. At each stage the load was packed underneath with huge baulks of timber until the total requisite lift of 18 feet had been achieved. The lower illustration on this page shows the amazing assembly of packing baulks that were required to support the stator at its final level.



An 82-ton stator for an electric generator being lifted into position at the Brimsdown Power Station. The illustration shows the large amount of packing required to support the stator while it was being lifted. For our illustration we are indebted to the Metropolitan-Vickers Electrical Co. Ltd.

The stator was finally winched upon steel rollers into position beside the turbine. The work was carried out by Norman E. Box and Pickfords Ltd.

A New Bridge across the Zambesi

A new suspension bridge is to be built across the River Zambesi at the Chirunda Gorge, 250 miles from Salisbury, the capital of Southern Rhodesia. The bridge will form part of a direct route between Salisbury and Lusaka, the capital of Northern Rhodesia.

The new structure will be named the Chirunda Bridge, and will cross the bed of the Zambesi river in a single span of 1,050 ft., with four short approach spans of 40 ft. each at its southern end. The span will be supported by two steel wire cables 8 in. in diameter, which will be anchored in tunnels cut in the rock on each side, and will pass over massive steel towers 120 ft. high on the river banks.

The deck of the bridge will be 65 ft. above the normal water level and will be hung from the cables by suspended ropes, and stiffened on each side by a lattice girder. A concrete roadway 18 ft. wide, and two footpaths, will be carried by the bridge.

The whole of the steel and wire will be manufactured and fabricated at the works of Dorman, Long and Co. Ltd., Middlesbrough.

Improvements at Port of Hamburg

Improvements of an interesting and important nature are to be carried out at the Port of Hamburg. The work will be spread over a period of about 15 years and will include the construction of a fine suspension bridge 1,650 ft. long over the river Elbe. The bridge will be carried 230 ft. clear of the water by great steel pylons 460 ft. in height. In order to provide better facilities for berthing modern ocean liners it is proposed to build a new quay, 3,300 ft. in length, which will permit four 20,000-ton ships to moor alongside at one time.

A Powerful Motor Siren

A motor driven siren that can be heard distinctly at a distance of five miles, and which is considered by experts to solve the problem of giving effective alarm in case of air raids, has been invented by Mr. Ekman, a Stockholm engineer. The new siren is estimated to be 14 times stronger than any other previously constructed, and will awaken a person sleeping within a radius of a quarter of a mile, while the noise it makes is almost unbearable for people within a radius of about 200 ft.

An interesting test of the siren was carried out in England recently. Competing against the noise of London traffic at a time when there was a wind of approximately 33 ft. a second, the sound of the siren was heard distinctly at a distance of nearly five miles.

Mr. Ekman also has invented automatic fire alarm and protection systems.

The World's Largest Transformers

Giants Rated at 125,000 Horse Power

IN the Grid system that now stretches over Great Britain supplies of electric power are transmitted long distances at the remarkably high pressure of 132,000 volts, and intermediate voltages also are used. These voltages are far higher than those of current supplies for household purposes and for use in industry. They are employed because losses in the overhead wires are less than they would be with transmission at a lower voltage, while the size of the conductor required also is proportionately less.

The great alternators that generate the current at power stations do not work at the high transmission voltages, which are obtained by means of large transformers. Other transformers installed at distributing stations receive the incoming high voltage current and step it down to that required for use, and the design and construction of suitable transformers is a very important part of any modern electrical undertaking.

The principle upon which a transformer works was discovered by Michael Faraday, the father of the great electrical industries of to-day. In one of his experiments Faraday wound two insulated coils of wire on an iron ring. The first or primary coil was connected to a battery, while the circuit of the second, or secondary coil, included a galvanometer. Whenever current was switched on or off in the primary coil, the needle of the galvanometer moved, showing that a current was induced in the secondary coil.

The voltage of the current induced in this manner depends on the relative numbers of turns of wire in the two coils. The secondary voltage is equal to that of the primary current if the number of turns is the same in each coil, but is larger if there are more turns in the secondary winding. Thus if there are 10 turns in the primary coil and 100 turns in the secondary, the voltage in the latter is 10 times that of the primary.

The current generated at most power stations is alternating, that is, it changes its direction many times a second, and at other stations a changeover from direct to alternating current is to be made as soon as this step is practicable. The standard rate of change adopted in connection with the Grid scheme is 50 times a second, and the current is said to have a frequency of 50 cycles. For current of this kind the transformer gives an easy means of changing the voltage as required, since a current is induced in the secondary winding every time that in the primary coil changes direction, just as if this current were switched on or off 50 times a second. The actual frequency is of no importance, for whatever that of the primary current may be, that of the secondary current is the same.

The modern transformer is designed to deal with very heavy currents and is much larger than the pioneer one made by Faraday. The passing of large currents through its windings produces heat, which must be dissipated into the surrounding air. Cooling therefore is necessary, and for this purpose the core and the windings are enclosed in a large tank containing oil. The oil is an insulator and circulates round the coils to prevent undue rise in temperature by carrying away the heat produced, just as the water surrounding the cylinders of a motor car engine prevents these from getting too hot. The greatest rise in temperature that can be allowed in a transformer is 50 deg. C., and in large transformers a pump drives the oil through the tank and into radiator tubes where it is cooled. In some cases the oil circulates through coolers containing pipes through which cold water is pumped.



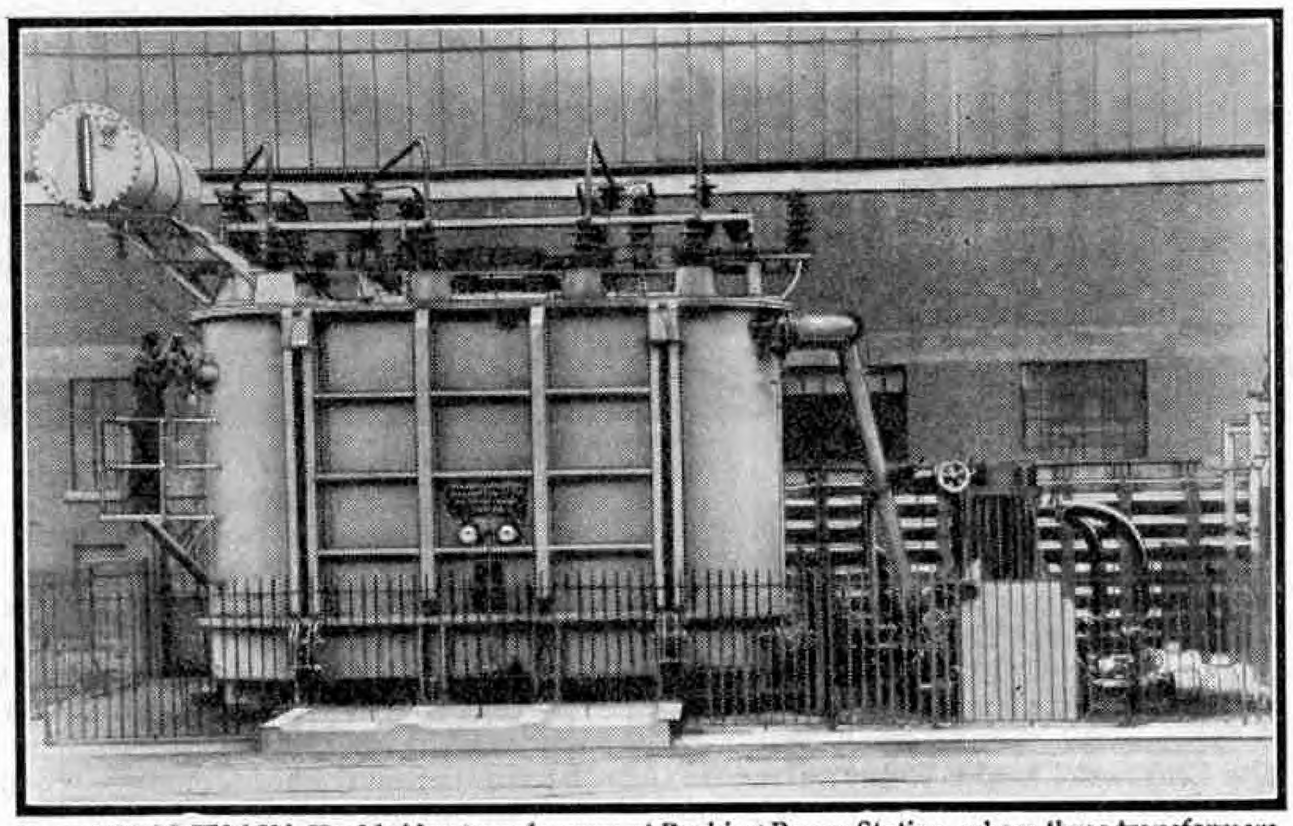
One of the world's largest transformers being lifted by a giant floating crane into a barge in order to cross the Thames on its journey to Barking Power Station. The illustrations to this article are reproduced by courtesy of the Hackbridge Electric Construction Co. Ltd.

As the demand for electric power has increased, larger transformers have been designed and built, and the coming of the Grid scheme has led to the construction of the largest transformers yet seen. These have recently been installed at the Barking Power Station of the County of London Electric Supply Company by the Hackbridge Electric Construction Co. Ltd. There are three of them, and all are step-up transformers, converting the voltage of the electric current generated at the station from 12,500 to 33,000. Each is rated at 93,750 kVA. What this means can best be realised by comparison of the electric power they pass on with that required for an ordinary electric lamp. Lamps are rated in watts, which are obtained by multiplying amperes by volts, and lamps of 60 or 100 watts are usually employed for household purposes. For technical reasons alternating current machinery is rated in terms of volt-amperes instead of the watts obtained by multiplying them together, and the kilovolt-ampere, or kVA, is 1,000 volt-amperes. Thus the power rating of each of these giant transformers is nearly 100 million volt-amperes, and this is equivalent to 125,000 h.p.

The illustration on this page gives an idea of the immense size of these transformers. Each has a tank 20 ft. 5 in.

long, 8 ft. 7 in. wide and 14 ft. 3 in. deep, and the weight of the entire transformer, including the core, coils and tank, but not taking into account the cooling oil and the various auxiliaries, is practically 120 tons.

The immense tank is of welded construction and is built in two sections separated by an oil-tight joint. The joint also had to be made proof against leakage of air at a pressure of 8 lbs. per sq. in. This pressure was applied externally when the interior of the tank was partially evacuated during the drying-out process before the assembly of the transformer, and the plating also had to be heavily stiffened in order to enable it to withstand the pressure. The joint between the lid and the upper section of the tank is similar to that between its two sections.



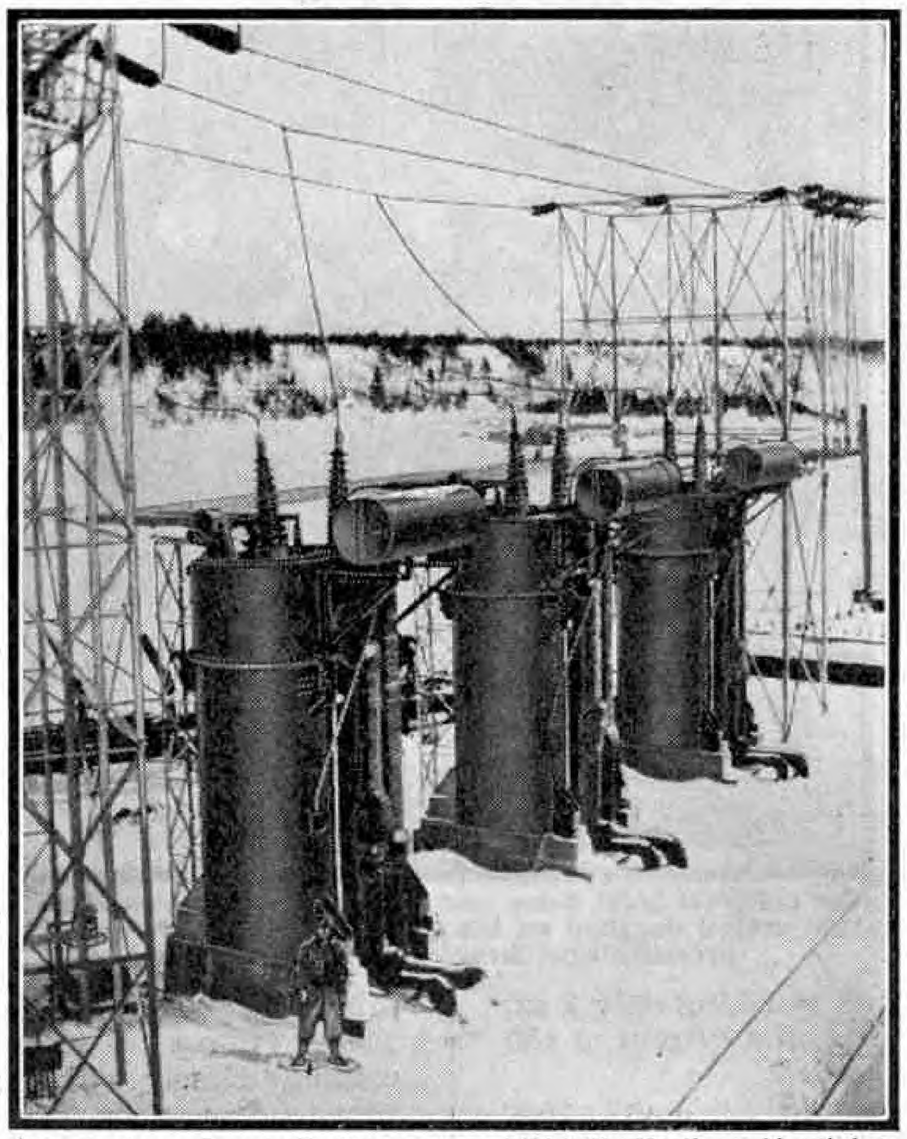
One of the 93,750 kVA Hackbridge transformers at Barking Power Station, where three transformers of this rating have been installed.

The immense core of the transformer has five limbs, connected by top and bottom members to form a framework 18 ft. 6 in. long and 10 ft. 6 in. high. It is built of stalloy, an alloy with special properties that has been developed for work of this kind, and weighs 70 tons, the necessary bolts and clamping plates bringing up the total weight to 76 tons. The effect of the stalloy core is to concentrate within it the magnetic lines of force developed by the rapid changes in direction of the primary current, and this has the effect of making the transformer as efficient as possible. Losses due to heating and other causes of course are unavoidable and for this reason the voltage developed in the secondary is always a little less than the simple calculation on the lines of that already given would indicate.

The coils, three in number, are placed round the three inner limbs of this gigantic framework, which act as their cores. They are so constructed that the complete winding on each limb, together with its clamping devices, forms a unit that can be lifted from its core without disturbing the windings of the remaining limbs. This is a typical Hackbridge construction that makes it comparatively easy to assemble the windings on their cores. It also provides a very rigid construction to resist the powerful forces set up if the transformer is short-circuited, which would cause a very heavy current to flow in the windings.

The cooling arrangements are very thorough. The ducts through which the cooling oil flows are so arranged that every turn in the windings is always in contact with the liquid, of which 6,000 gal. are continually circulating in each transformer. The heated oil is driven by an electric pump through a separate installation in which it is cooled by water. The complete installation for a transformer is divided into two sections, each of which is complete with its own oil and water-circulating pumps. Up to half load only one cooling section is at work, and the second is brought into operation automatically when the load rises above this limit.

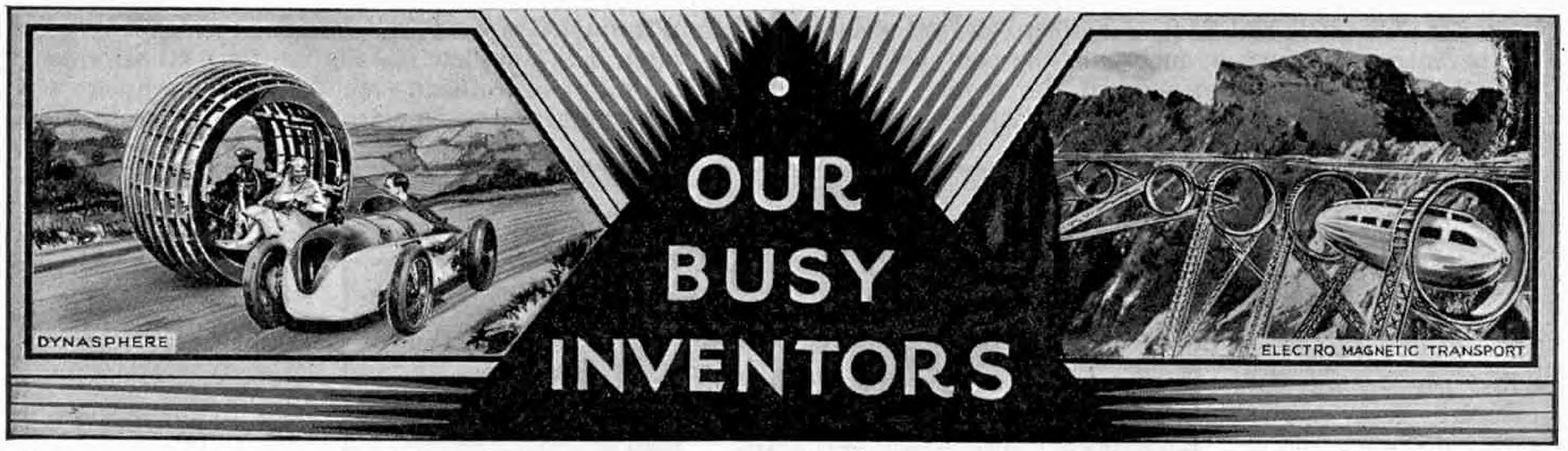
The carriage of giant transformers from the works in which they are built to the stations at which they are to be installed requires very careful arrangement owing to the unusual size and shape of the load. The first of the three transformers for the Barking Power Station was transported on the world's largest lorry, which was fully described and illustrated in the "*M.M.*" for February 1931, and the crossing of the Thames was made in a barge into which it was lifted by the "*Mammoth*," the great floating crane of the Port of London Authority. The crane is shown lifting this transformer in the illustration on the opposite page. The second transformer was taken to its destination in a similar manner, but the third travelled all the way by road, crossing the river by bridge.



A bank of transformers in the snow, supplying the Northern Aluminium Company of Canada at Dolbeau, Quebec. The rating of the bank is 56,250 kVA, with voltage reduction from 154,000 to 13,200.

The three giant transformers work in the open air, a common practice in modern electrical engineering, and with other similar units make up a very imposing line. One of them is shown in position in the upper illustration on this page, in which the huge insulators carrying the terminals of the coils can be seen on top of the tank, with the oil cooler on their left. A special platform is provided to give access to the handwheel by means of which the switch for changing the output voltage is operated.

Transformers can be installed outdoors in far more severe conditions than those prevailing at Barking. The large bank of transformers standing in snow that is shown in the lower illustration on this page is an interesting example of this. The bank is one of eight installed at various stations of the Northern Aluminium Company of Canada by the Hackbridge Electric Construction Co. Ltd., and is at Dolbeau, in the province of Quebec. These units operate at very low temperatures in winter, when the thermometer may fall as much as 40 deg. F. to 50 deg. F. below zero. High temperatures in summer are equally trying, while very severe thunderstorms also may occur, the violent lightning then imposing great strains on the transmission lines and the transformers connected to them.



Automatic Switch for Car Lights

I heard recently of a very ingenious means of automatically switching on the lights of motor cars left parked in places where they must show a light when darkness comes. The device used for this purpose is an electric relay operated by light, and is simple in action, costs little to install and does not require inspection or special attention when in use.

This invention is known as the Chilowski Light Relay, after its inventor, and its working depends on the fact, familiar to those of my readers who have any knowledge of chemistry, that if a mixture of equal volumes of hydrogen and chlorine is exposed to sunlight the two gases combine. The two unite more quickly when the intensity of the light falling upon them increases, but in complete darkness there is no action at all.

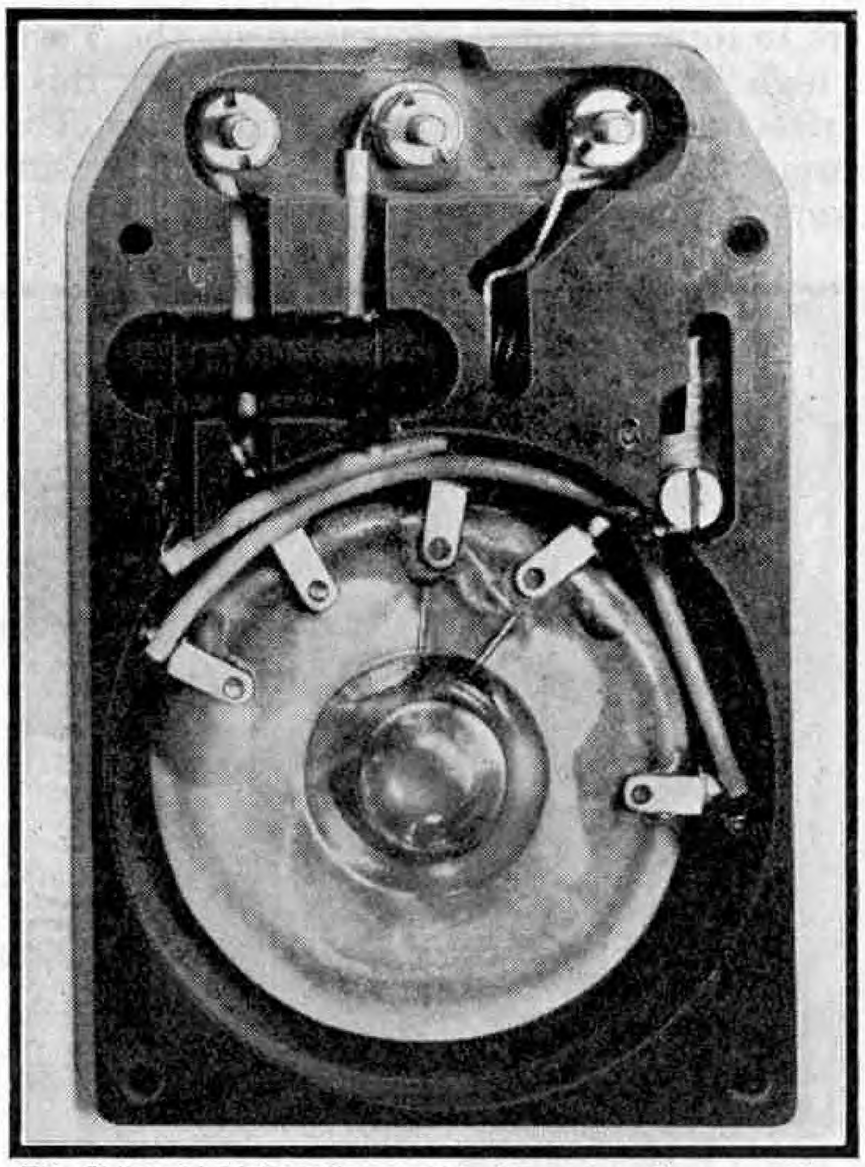
The relay that Chilowski constructed on the basis of this chemical change consists of a very small glass bulb half filled with hydrochloric acid solution. Two electrodes are sealed through the glass so that current can be passed through the liquid from the car battery, and electrolysis then takes place, hydrogen and chlorine being produced within the bulb. While daylight lasts the hydrogen and chlorine recombine and the total pressure of the gases in the bulb remain unchanged. When darkness comes and the gases no longer unite with each other, however, the pressure inside the bulb increases, and a thin flexible membrane that forms one side of it is pushed outward. This movement operates a switch, or moves a column of mercury that closes an electric circuit, thus automatically switching on the lights controlled by the relay.

The device includes a cutout that the driver can operate on entering his garage, or in any other circumstances in which the parking light is not required, and this cutout is automatically released on starting up the following morning, leaving the light relay ready for action.

Inventor's Three Years' Work

Three years of continuous effort have gone into the production of the Chilowski Relay in its present light and handy form. As used for car parking lights the entire device is assembled within a glass disc 2 in. in diameter and $\frac{1}{2}$ in. in depth, and weighing only 2 oz. Yet the unit is robust enough to switch on and off a current of 150 watts, with a time lag of only about half a second.

It is easy to see that the new relay can be used for many other purposes besides the one I have mentioned. For instance, it can be applied to the automatic switching on or off of the electric lighting of railway coaches, streets, display windows and road signs and traffic lights of all kinds. Its simplicity of operation should make it very valuable, and larger units than the one used for car parking lights are being developed.



The Chilowski Light Relay used in the automatic car parking light control described on this page. Photograph by courtesy of International Technical Developments Ltd.

A New Type of Key

Locks that are operated by turning keys have been familiar to us for so many centuries that it seems impossible to imagine a key that is not intended to do this work. Yet a key of this revolutionary type has now been produced. It consists of a thin strip of perforated metal or fibre, which controls the tumblers of the lock in such a manner that this can be opened by turning a handle. The key itself does not move, but simply acts as a release.

The keyhole of a lock provided with keys on this new system is a very narrow slit, and it is claimed that the lock therefore cannot be picked. Owners can make keys for themselves, using a paper pattern that is provided with each lock, and without the pattern the correct key cannot be made from a blank, for this gives no indication of the internal arrangements when it is inserted in the lock.

One advantage of the new key is that it is very light, and a dozen or more keys on a ring of suitable size do not make a large and clumsy mass of ironmongery, but can easily be slipped in the waistcoat pocket. Master keys can be designed without difficulty, and practically all types of locking mechanisms can be adapted for the use of this new system.

Houses Built by Mass Production

There is a tendency to-day to make everything by mass production methods, and it seems to me that before long we shall even have houses built in this manner and delivered ready made from the factory. A steel house welded electrically throughout actually was made recently in a factory in the United States, hoisted on to a 16-wheeled trailer and hauled away to the site it was intended to occupy. Other houses are to follow it, and like the first one, no doubt will be delivered ready for immediate occupation, and having even the heating furnace in full operation.

This all-steel house has asbestos board ceilings and walls, and wooden doors, but further houses built on the same plan are entirely of steel, except for heat insulating materials within the walls and between the ceilings and the roof. A few hours are sufficient to enable water and electric light and power connections to be made, the decorations to be carried out and the furniture to be installed. At present three weeks is sufficient for the construction of an all-steel house, and no doubt this process could be speeded up if the demand warranted it.

Detecting Microscopic Cracks

The breakage of a highly stressed part in a modern machine can often be traced to the growth of a very tiny crack originally present in the material. Such a crack may be so minute that it is invisible to the naked eye, and it is scarcely possible to examine closely with a microscope the surface of every part that requires inspecting. Fortunately cracks of this kind in steel can be discovered very easily by means of the magnetic detector, and an ingenious universal crack detection equipment of this kind for testing small parts is illustrated on the next page. It has been developed by the Metropolitan-Vickers Electrical Co. Ltd., and its central feature is the means adopted for producing a magnetic field that changes direction so as to sweep at right angles across all cracks.

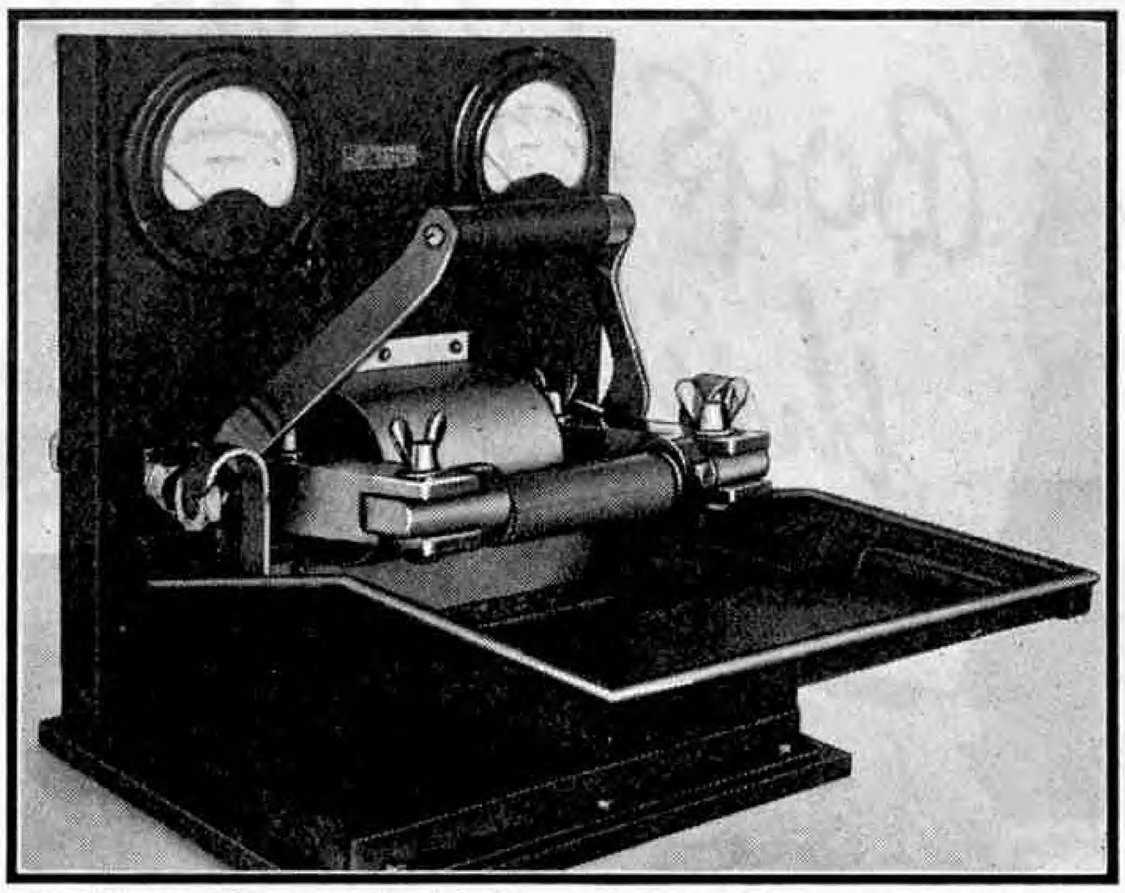
This magnetic field plays an all-important part in the detection of the cracks, for it is used to magnetise the part to be tested, which is then dipped into a bath of fluid containing iron dust in suspension. The particles of iron in the liquid are attracted to the crack, which distorts the magnetic field produced, and immediately revealed as fine black lines on the bright metallic surfaces.

A Roving Magnetic Field

The value of the roving magnetic field is due to the fact that the method is most effective when the cracks are at right angles to the direction of magnetism. It is produced by passing a heavy alternating current through the specimen, and at the same time magnetising it by means of a direct current electro-magnet. The alternating current produces a magnetic field of varying strength, and this is circular and thus different in direction from the other one. The resultant of the two is a changing field that sweeps perpendicularly across all cracks, whatever their direction.

Both surface cracks and those inside the material are shown up by this valuable method. The iron particles tend to bridge the narrow gaps caused by cracks on the surface, and internal faults are revealed by a concentration of iron particles above them. A spring that has been tested by this method is shown in the lower illustration on this page, and it is easy to see on it cracks that would not be detected by ordinary means of examination.

Parts with surfaces that are rough or black, on which the concentration of iron particles is not readily visible, are sprayed with aluminium paint in order to give a suitable background. The size of a part or its position are no obstacles to tests of this kind, for there are many forms in which they can be applied in special cases. For instance, it is inconvenient to use the ordinary method for the flat surface of large objects, such as the welded metal added to a worn railway point that has been repaired. A layer of magnetic fluid in a circular airtight cell is placed on the surface to be tested, and the cracks are revealed by the movements of the iron dust in this fluid when the part is magnetised. This is done by placing a horseshoe shaped electro-magnet on the line, with the part to be examined between the poles.



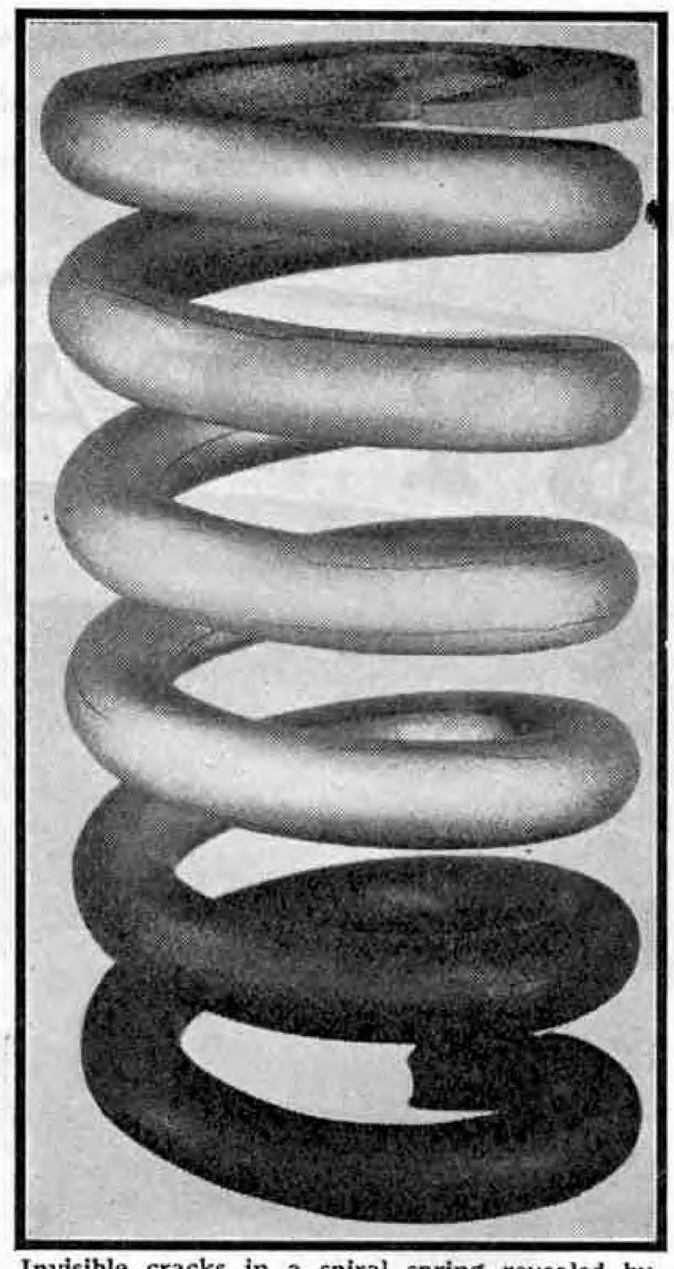
The "Universal" equipment for detecting cracks in small steel parts. The photographs on this page are reproduced by courtesy of Metropolitan-Vickers Electrical Co. Ltd.

Telephone Cord that Cannot Kink

Nothing is more irritating than a telephone cord that persists in twisting itself into knots, which become worse every time the instrument is lifted from its rest. Various efforts have been made to prevent this twisting by means of mechanical devices, often using springs, but in practice these have proved unsatisfactory. Now the problem has been solved by the introduction of an extensible cord that cannot kink. The conductors in this are not laid parallel to each other, as in the ordinary cord, but are braided round a central elastic core on a specially designed machine. Each cord is capable of extending to twice its length. Thus it takes up little room when not in use, and has the further advantage of being less inclined to entangle itself with papers and other articles kept on desks.

A New Kind of Sound Film

The film usually employed in the production of moving pictures and generally for sound recording has the sound track photographed on it. In an invention that is claimed to give excellent reproduction the track is simply cut out of the film by means of a knife. The celluloid ribbon used in this process has a dark opaque layer on its surface, and the sound vibrations are made to act upon a vertical knife that cuts patches of varying depth and width in this layer. When the film intercepts the beam of light passing to the photo-electric cell of a reproducing device, it gives the same result as the photographic record on the usual type of film. The great advantage of the invention is that no development is necessary. The film is ready for use immediately it is cut, without any necessity for carrying out laborious operations.



Invisible cracks in a spiral spring revealed by magnetic treatment.

Faster and Steadier Bullets!

It is scarcely to be expected that the inventor will refrain from trying to improve weapons of all kinds, and not long ago gave an interesting product of his ingenuity by the production of a rifle bullet that was said to be steadier than those of the ordinary kind when in flight and to have four times their acceleration. The secret of the new bullet lies in a cup-shaped base twice the diameter of the rest of it, for this gives a greater surface area for the expanding gases produced by the explosion to work upon. The base serves a further purpose, for the rifling of the gun from which the bullet is fired is so shaped that the metal of the cup is changed in form to produce fins. These act as steadying surfaces during flight, keeping the bullet more directly on its intended course, somewhat in the same manner as the feathers of an arrow.

Rubber Strips for Tree Surgery

It almost seems as if there is no limit to the value of rubber, and the inventor is always at work finding some new use for it. A special form of this material has now been developed for the purpose of filling up cavities in the trunks of diseased trees, especially famous old trees that are worthy of preservation. In the form of tree surgery that can now be practised, the decayed wood is scraped away and the cavity is closed by a wall built up of strips of the special rubber. Each strip is cut slightly longer than the width of the cavity in order to give a tight air-proof fit by compression, and the space behind the wall is filled with a cement that does not shrink.

The special rubber prepared for use in tree surgery resists the attack of sunlight and is capable of withstanding exposure to bad weather and to high and low temperatures. A further advantage is that the swaying movements of the trees treated with it do not cause it to crack. Its colour does not differ so greatly from the rest of the tree as to arouse attention, and natural bark actually spreads over the filled area.

Another interesting development is the introduction of a new method of making rubber thread. So far this has been made by forcing latex, or liquid rubber from the trees, through tiny openings into a chemical bath, where the rubber coagulated. Now a simpler device for carrying out this operation has been invented. It comprises a heated cylinder, with continuous grooves on it, that rotates over a tank of latex. The liquid is picked up in the grooves, where it is dried by the heat of the cylinder to form the thread. This is stripped off and wound on a spool as fast as it is produced. There is no need for special baths, and the latex itself requires no special preparation or manipulation, so that it retains its natural strength.

A Wonderful Engraving Machine

We often read of such remarkable feats of engraving as inscribing the Lord's Prayer on the head of a pin. These are accomplished by hand, but a machine has now been devised that has broken all records by engraving the 300 characters of the Prayer within a circle as large as the point of a rather dull pin. The diameter of this circle was only twice that of a human hair, and 200 circles of the same size would have to be placed in a line in order to make up a length of one inch.

The characters were perfectly legible. They were reproduced by means of a pantograph arrangement from a copy of the Lord's Prayer previously printed within a circle of two inches in diameter, and the progress of the engraving was followed with the aid of a microscope.







1 2

THE BEST OF OUTDOOR PASTIMES

Boys! If you're out to get the last ounce of fun from the most thrilling outdoor hobby a boy can have, get a Hornby Speed Boat! Model motor boating is within the reach of almost every boy, for it is one of the least expensive of all summer pastimes, and provides hours of fun and excitement. It can be carried on at any time without special preparation, either alone or with friends. Hornby Speed Boats and Racers are the finest model craft of their kind in the world—beautifully made and superbly finished. The Hornby clockwork mechanisms are amazingly powerful; they go fast and far, and are always dependable. Your local dealer will show you all the models—from the out-and-out racers to the smart limousines—and whichever you choose, you can be sure that it will be a champion of the pond!

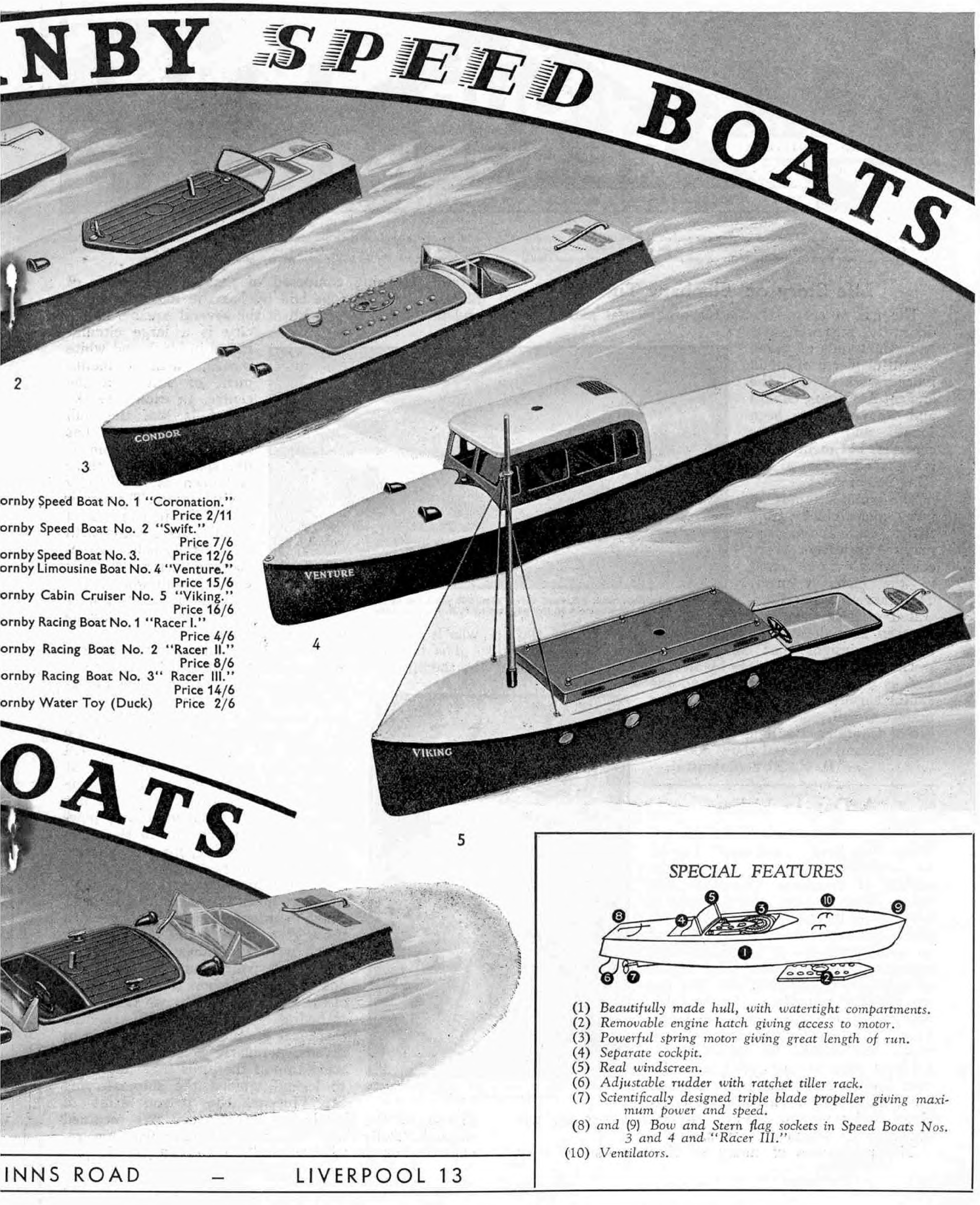
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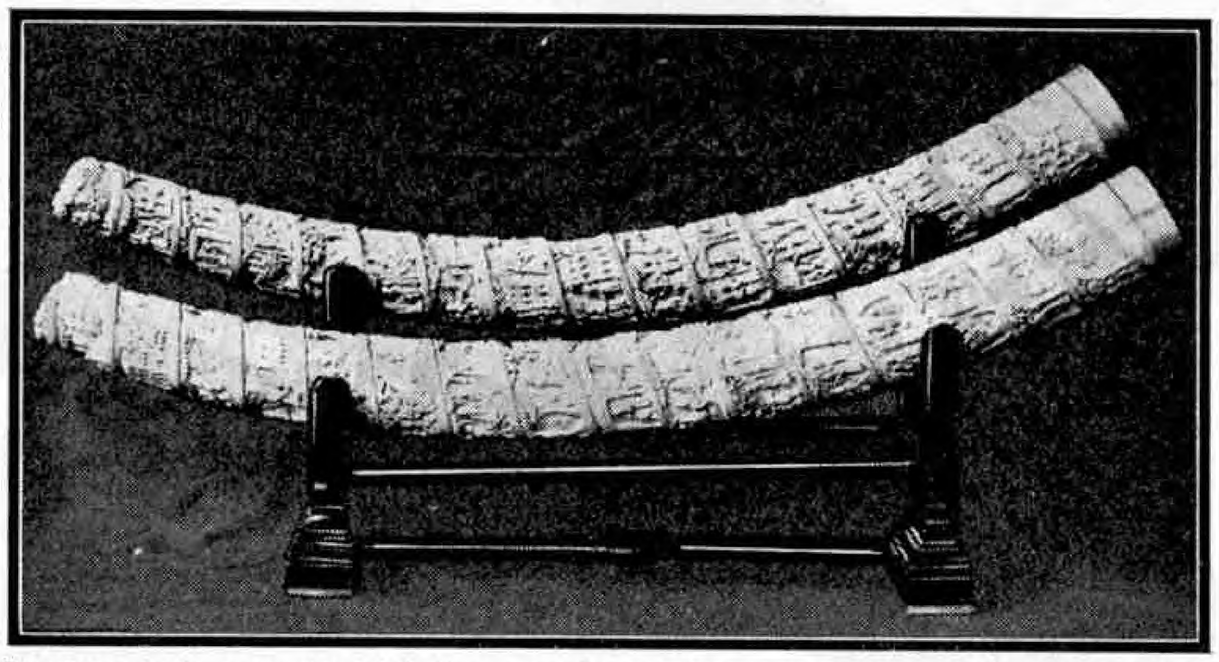
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Life Story on Elephant Tusks

The use of carved ivory for ornamental and other decorative purposes dates back thousands of years. Beautiful pieces of inlaid ivory worked by the ancient Assyrians, Greeks and Romans have been found, and documents centuries old mention an ivory throne carved for King Solomon.

The world's supply of ivory comes chiefly from Africa and India, and many beautiful ivory carvings are to be found in the latter country. The carved tusks illustrated on this page can be seen in Calcutta, and are a rare example of the exquisite designs that can be produced. They were worked about 200 years ago by an Indian sculptor. Each tusk is about 4 ft. in length, and the skilful carvings, finished in the most minute detail, show scenes from the life of Gautama Buddha, the founder of Buddhism, who lived about 500 B.C.

P. N. Roy (Calcutta).



Two ivory tusks, eacn about 4 ft. long, carved some 200 years ago by an Indian sculptor. The photographs on this page are by P. N. Roy, Calcutta.



A close-up view of one of the tusks showing the skilfully worked designs.

A Day in Lisbon

While on a cruise on the Cunard White Star liner "*Lancastria*" I spent an interesting day in Lisbon, the capital of Portugal. The boat tied up at about 9 a.m., and a party of passengers, including myself, immediately went ashore. During the day we made great use of the single deck tramcars that form the chief means of transport in the city. The first car we boarded ran along the dockside road, which is divided into four lanes. There is a cobbled road for heavy traffic and cattle, an asphalt road for light vehicles and cycles, a boulevard for tramcars, and lastly a track for electric trains. This method effectively splits up the traffic, and motor cars are not hindered by trams or lorries.

The pavements of many of the streets are very attractive, being composed of many small pieces of black and white stone laid by hand in mosaic designs, and in the centre of each of the several squares in the city is a large circular island in black and white mosaic, with a monument or statue in the centre. In each case the island is like the hub of a wheel, and has roads radiating from it like spokes. One of these is known as the "Rolly Polly" square. The mosaic design in it consists of a white background with black "rolly polly" waves running across it. The effect is somewhat startling, and is said to render uncomfortable anyone who is at all inclined to seasickness.

The bull ring in Lisbon was built many years ago by the Spaniards, who conducted bull fights in it according to Spanish traditions. The Portuguese bull fights now carried on are more humane. The bull is not harmed, the toreador showing his skill by avoiding its rushes, and it is led away when it becomes tired. Great crowds attend the fights, and become very excited at times. They do not throw the seat cushions about, however, as was the custom in the early days of bull-fighting, for this practice has been prohibited by law.

We continued our tour on foot, walking down pleasant avenues in which gardens were railed off. In these grow flowers and trees, among which were a number of date palms that bear fruit, but the dates do not ripen, as Lisbon is too far north of the Equator. Finally, we visited the cathedral, built in 1150. In the cathedral grounds are kept a pair of ravens, popularly believed to be descendants of the birds that, according to legend, guided the ship carrying St. Vincent, the patron saint of Lisbon, to the city in the 3rd century. We returned through "Rolly Polly" square to the quay, where we re-embarked on the "*Lancastria*." J. Oliver (Barking).

A Visit to Arendal

The south east coast of Norway is marked by wooded slopes and towering cliffs that can be seen from a boat when still many miles out at sea. So impressive are the height and solidity of these natural walls that it is not until the boat nears land that towns nestling under them can be seen. This was my experience recently when sailing into Arendal, a small town lying at the mouth of the River Nid. The river forms a fine natural harbour, on each side of which light-coloured houses stretch down to the water's edge. The main part of the town is to the north, and after landing on the quay there, the first thing I noticed was the market place, where all kinds of fruit were being sold at very low prices.

In the main street of Arendal are many shops, including an abnormal number selling sweets and ice cream. Most of the cars I saw in the town were of English or American manufacture, and all had the steering wheel on the left side. English petrol was on sale at all garages.

Picturesque national costumes are worn on special occasions. These attract attention by their very simplicity, as the photograph reproduced as the upper illustration on this page shows. I was greatly impressed by the politeness and kindness of the inhabitants. The policemen especially were always glad to help, and never failed to salute before answering a question.

Towards the close of my visit I spent a day climbing the hills that form the hinterland of the town. The view seaward from the summits of these hills is truly wonderful, and I shall long remember the colourful picture made by the green of the wooded slopes running down to blend with the clear blue of the sea.

R. WOOLF (London).



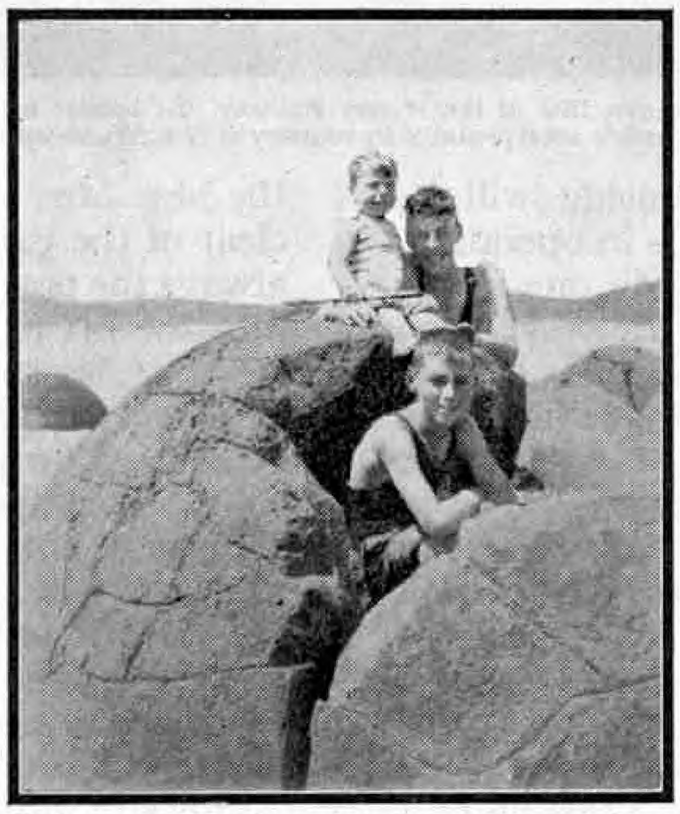
A Norwegian girl wearing picturesque national costume. Photograph by R. Woolf, London.

The Moeraki Boulders

At Hampden, a seaside resort near Moeraki, in the South Island of New Zealand, are to be seen a number of large round boulders of curious formation. Many are over 6 ft. in diameter, and they present a strange appearance as they lie strewn about the beach, like so many giant footballs. At least that is what they looked like to me on first seeing them when on holiday at Hampden.

These boulders are not to be found in any other part of the Island, and so have attracted much attention. They are not really boulders at all, but fine examples of a structure known by geologists as "septarian concretions." This simply means that they were formed many years ago from the muddy clay of which the cliffs at Hampden are composed, and in the course of time have solidified. Other boulders that have not yet freed themselves can be seen in the cliff.

R. DICKISON (Dunedin, N.Z.).



Curious round boulders found near Moeraki, New Zealand. Photograph by R. Dickison, Dunedin, N.Z.

How Biscuits are Made

Most readers are partial to biscuits, and no doubt will be interested to hear how they are made. As foreman or production engineer in a large biscuit-making factory I am able to give some idea what these processes are.

On arrival at the factory, the flour is cleaned and weighed and then conveyed to the mixing room. There it is placed in a machine with sufficient water to make dough, which is carried to a dough break. This is a machine similar to a large mangle, and is fitted with chilled iron rollers that roll the dough backward and forward, kneading it into a sheet about 4 ft. long and 3 ft. wide.

The sheet is passed to the next machine, which has two sets of highly polished rolls, each 3 ft. wide. These are called gauge rolls, and they reduce the thickness of the dough to about twice that actually required, before it is carried on a canvas belt conveyor to a second set of gauge or finishing rolls that give it the correct thickness. The dough is then conveyed by means of another belt first under a flour sprinkler and then to a rotating brush that spreads the flour evenly on the moving sheet of dough.

Cutting is the next operation. The cutters are fixed to a large steel bridge called the cutter crosshead, and their speed varies according to the type of biscuit being cut. The average number of strokes is between 160 and 200 a minute, and at each stroke up to 18 biscuits are cut.

The biscuits, still in dough form, are now ready for baking. They travel through the oven in baking pans carried on a conveyor. The ovens are 70 to 100 ft. long, and are built in tiers so that the biscuits make four complete circuits before being completely baked. The biscuits are next carried to a cooling plant, of which they make six or seven circuits while fans blow cool air on them, and are then lifted from the pans in a suction plant and deposited on a stacker. On yet another conveyor they pass in even rows along the packing tables, where they are placed in cartons, which are then weighed and automatically closed.

The complete cartons pass to a rotating check weigher that rejects those that weigh too much or too little, allowing only correctly weighed cartons to pass on to the wrapping machine, where two wax wrappers are placed round them and a final covering comprising the paper label is then gummed down.

The finished cartons are finally placed in cases holding 16 to 20 packages, which in their turn are sealed by a machine. They are then distributed to the various floors of the stockroom, elevators and electric trucks being used for this purpose. Chutes return them to the ground floor for dispatch.

S. W. HUMPHREY (Harrow).

The New Lifts of the Mersey Railway

Largest and Fastest in Great Britain

FOUR of the largest high speed lifts ever installed in Great Britain have now been completed at the James Street Station of the Mersey Railway. This railway passes under the Mersey, connecting Liverpool with Birkenhead, and James Street Station is near the river on the Liverpool side, at a depth of about 80 ft. below ground. The new lifts work in a shaft 76 ft. deep. They are capable of travelling up and down at the rate of 400 ft. a minute, and normally take only 14 sec. for their journey. Thus travellers on the railway reaching James Street Station can be out in the open less than 20 sec. after entering one of the lifts in the station itself.

The lifts have been designed and constructed by Wm. Wadsworth and Sons Ltd., Bolton, and have been installed by them as part of a scheme for speeding up traffic on the Mersey Railway. This line is shortly to be associated with the L.M.S. in a complete electric service between the centre of Liverpool and New Brighton, Hoylake and West Kirby as well as Birkenhead, and traffic generally between Liverpool and the Wirral peninsula will be speeded up greatly when the new scheme is in operation.



Passengers entering one of the new lifts of the Mersey Railway, the largest high speed lifts in Great Britain. The illustrations to this article are reproduced by courtesy of Wm. Wadsworth and Sons Ltd., Bolton.

The actual transport of passengers is only one of the many responsibilities of an underground railway, however. Arrangements also must be made to convey passengers to and from street level by means of lifts or in some other manner, particularly when the stations are at depths of 50 ft. to 100 ft. and the distances are too great for the climb from them or descent to them to be made in comfort on foot. It is this that has led to the installation of the high speed lifts at James Street. These are the latest and finest of their kind, incorporating every known device to make them speedy and reliable in use, and comfortable and absolutely safe for passengers.

The lifts are automatic in operation, the pressing of a single button being sufficient to set them in motion and to stop them when they have completed each upward or downward journey. Suppose that one of the lifts is about to travel upward from the station level. When it is full the attendant presses the control button on the panel alongside the entrance. There is a momentary pause, and then a voice is heard saying *"Stand clear of the gates."* These words are not spoken by any human attendant, but are produced automatically by means of a sound film and a photo-electric cell device. They are repeated, and the gates then close automatically and the lift begins to ascend. It quickly reaches its maximum speed, which is reduced just before it completes its journey upward, so that the lift comes slowly to rest exactly at its proper level. The gates open immediately, and the passengers walk out at the opposite end to that at which they entered.

The procedure is similar with a descending lift, working throughout being smooth and easy. Each car carries 60 passengers in comfort, representing a load of about four tons, and while the full travelling speed is 400 ft. per min. it is possible to reduce this to 300 or 200 ft. per min. if required. Since the action throughout is automatic, once the button starting the sequence of operations has been pressed, the attendant does not travel with the lift, remaining always at the control point.

Remarkable safety measures have been adopted in designing and constructing the new lifts. Although passengers are warned to stand clear of the gates when these are about to close, there is always the possibility that a late comer dashing heedlessly into the lift may be trapped. He will come to no harm, however, for the pressure that the gates will exert as they close on him is not sufficient to do any damage. Ingenious elbow joints are used to push the gates together when the compressed air plant used comes into operation. These do not straighten out until the two gates are practically in contact, and until then very little effort is needed to push the gates back sufficiently to release anyone caught in them. The lift cannot begin to move until the gates are closed and these cannot then be opened, except by the means provided and operated automatically.

It is still more remarkable to find that one of these lifts will not fall, even if all the eight ropes by means of which it is suspended are cut. This sounds like a miracle, but in these circumstances an automatic safety device would come into play as soon as the lift gained speed, and this would apply an emergency friction brake that would hold the lift motionless in its guides. This automatic safety device was tested several times while the official inspection of the Ministry of Transport was being carried out.

The eight ropes suspending the cage under test were not actually cut, but steps were taken to produce a similar effect, and in each case the lift cage continued to travel less than six feet before coming to rest.

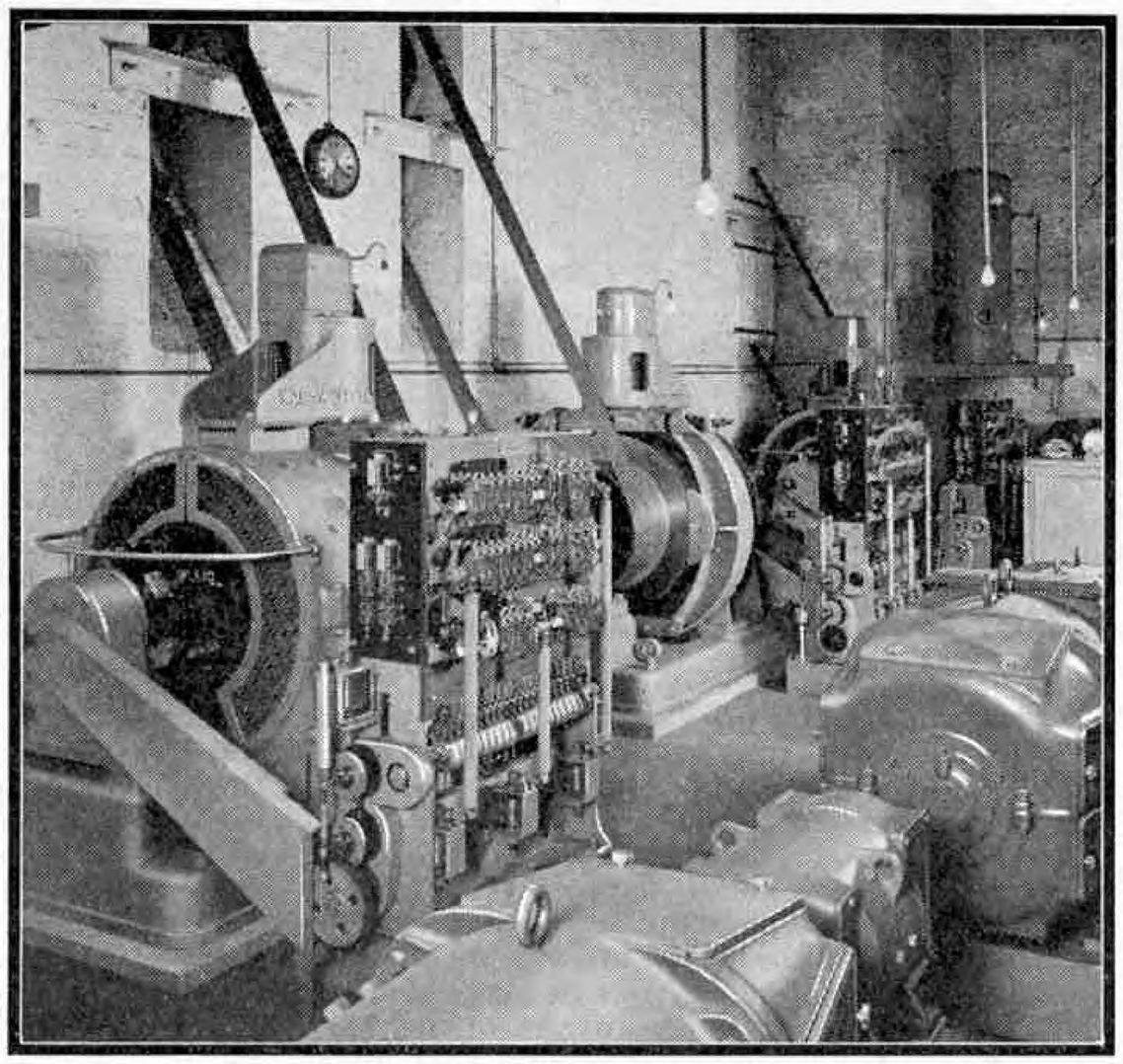
The lifts are arranged in pairs and emergency doors are provided in their sides at the exit ends, so that it is possible to pass from one lift of each pair to the other when these are at the same height. The lock and key of the door form a switch, for unless the door is locked the lift cannot be set in motion. The doors have been provided as an emergency measure for use in the remote contingency of one of the lifts coming to a stop between landings. In that case the adjoining lift could be taken up to the same level and the imprisoned passengers quickly released.



General view of the four new lifts. They are electrically-driven and are controlled automatically. A mechanical voice gives warning when the gates are about to close.

The mechanical voice that warns passengers when the gates are about to be closed is produced by a device similar in principle to that employed in the Post Office talking clock, which was fully described and illustrated in the *"M.M."* for August 1936. A disc carrying a film with a sound track on it is rotated slowly so that the track passes across a beam of light falling upon a photo-electric cell, and the varying current flowing through this is amplified and transmitted to a loud speaker.

Steel is the material of which the lift cages are made. They are lined with oak, and the floor is of a new modern material which is an improvement on linoleum, of hard wearing quality and pleasing appearance. They are designed for one-way traffic only, passengers entering at one end and leaving at the opposite end, so that those who are first in a lift are first out of it. This ensures that the fullest possible use will be made of them.



The lift motors and other machinery installed in the engine house. The hoisting ropes from the motors can be seen passing up into the lift shafts.

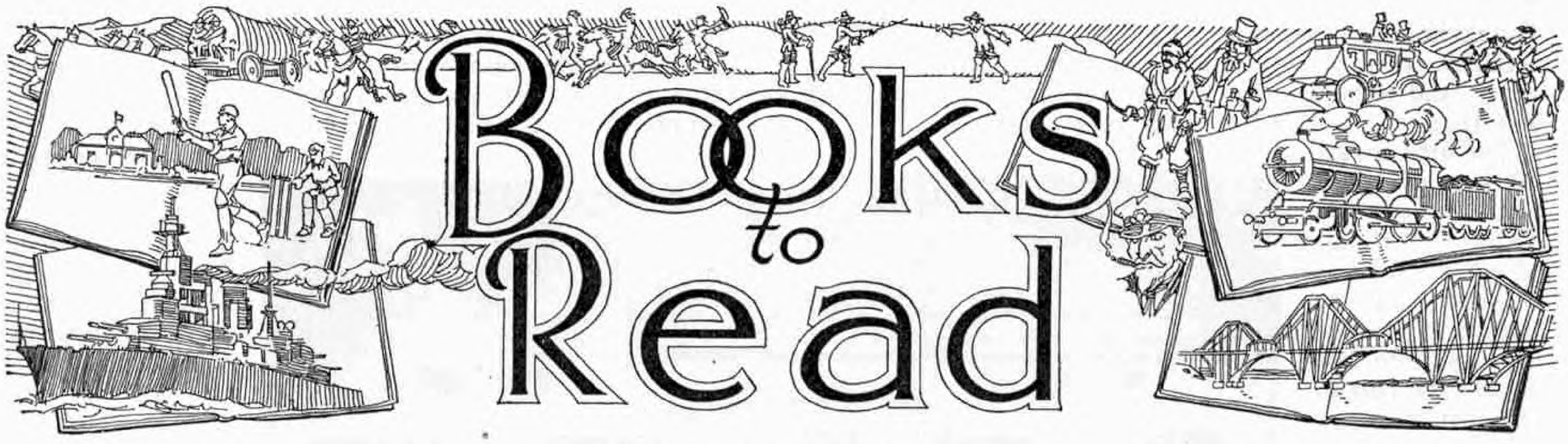
The lifts are operated electrically by means of motors of the gearless type. Motor generator sets are used to supply current to the driving motor, the speed of which is controlled by varying the voltage of the generator field by means of a multiple Wadsworth patent controller. The high voltage current used to operate the electric trains of the Mersey Railway is brought into the gear-room, and there, by means of motor generator sets, it is transformed into a variable voltage supply suitable for operating the large gearless lift motors. These sets are started and stopped automatically by push buttons at the lift control points at the street and station levels. There is also a control point in each lift which is available for use only by the engineering staff of the railway; incidentally, for inspection and testing, the lifts can be made to creep up and down at a slow speed of some 20 ft. per minute.

The machinery is installed in an engine house hewn out of rock almost at the level of the railway. The lift motors themselves are about 8 ft. in height, and with their brake gear weigh nearly six tons each. The hoisting ropes pass round the grooved hoisting sheave and up to the top of the lift shafts, in which are suspended the cars and balance weights, the use of which reduces the amount of power required to hoist any one of the cars. The hoisting sheave is directly connected to the armature of the motor and rotates at the same speed.

The smoothness with which the lifts are operated indeed is a particularly interesting feature of the installation. The speeding up and slowing down is effected swiftly, but is so nicely graded that there is no sinking feeling or disturbance of any kind at any time during either an upward or downward journey. Even a sudden electrically controlled emergency stop, which brings the lift to rest from full speed in less than four feet, produces only a slight momentary sense of upward pressure on the feet.

The old lifts at James Street Station were hydraulic and were said to be the largest passenger lifts in the world. There were four of them. One still remains, but the others have been removed to make way for the four new lifts, which were installed without disturbance to traffic.

The first pair replaced one of the existing hydraulic lifts in September 1936, after four weeks of night and day working to effect the changeover. The floor of the old lift was used as a platform by the men engaged in the task, and was lowered gradually as this work proceeded.

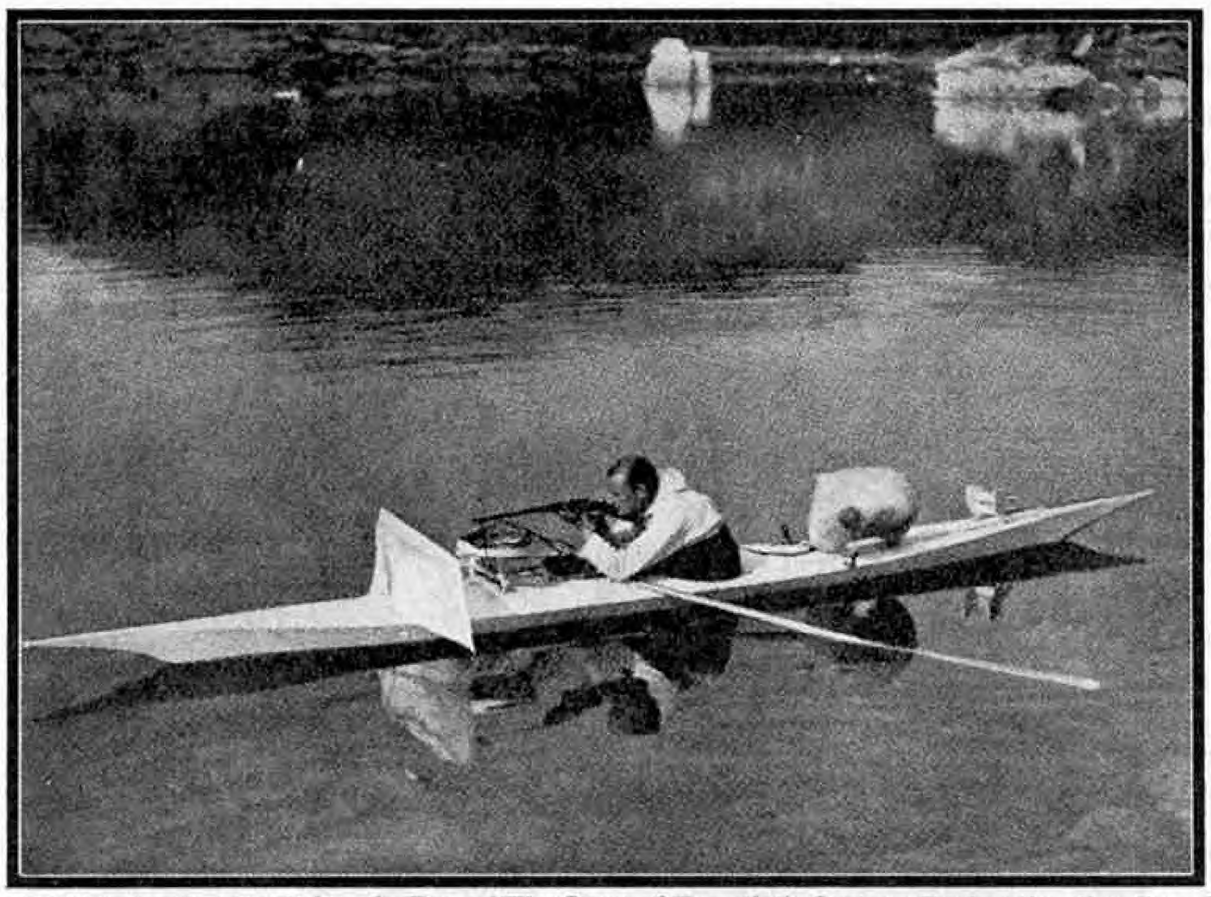


"The Story of Twentieth-Century Exploration"

By C. E. KEY, F.R.G.S. (Harrap. 7/6 net)

Most boys have dreamed of discovering unknown countries, and there are few who are not attracted by stories of adventurous journeys by sea and land. The great days of exploration are by no means over, and explorers indeed have been exceptionally busy during the 37 years of present century, the period covered by Mr. Key's book.

The story begins with the little-known adventures early in the century of Roosevelt and others who travelled through the mysterious regions of the Amazon. It also deals with the strange disappearance of Fawcett, in search of whom many explorers have risked their lives among the suspicious uncivilised Indians who live in the dark jungles. Then come the adventures of Sven Hedin and Stein in the wastes of Asia and Tibet, the search for Ophir and the crossing of the Empty Quarter in Arabia. The story of the conquest of the Poles and the adventures of such men as Gino Watkins amid the snow and ice of Arctic and Antarctic lands will be particularly attractive to most readers, for it is in these regions that the aeroplane and the airship have been of the greatest service. Mr. Key's accounts of the exploits of Amundsen, Byrd, Wilkins and Lincoln Ellsworth are of special interest just now, when Russian airmen have flown to the North Pole and also have made a record long distance flight across the roof of the world.



Watkins hunting in his kayak. From "The Story of Twentieth-Century Exploration," reviewed on this page, and reproduced from "Gino Watkins," by J. M. Scott (Hodder and Stoughton Ltd.) by courtesy of the author.

Mountaineering is the subject of special chapters on the conquest of Mount Kamet, the highest mountain in the British Empire, and the successive assaults on Mount Everest, including the great flights that were made over the summit. One chapter describes how the riddle of the Sahara is gradually being solved, and another deals with the as yet little-known discoveries of cannibals and pigmies in New Guinea. Much has been written on these and other expeditions of recent years by men who have taken part in them, and Mr. Key's graphic accounts enable his readers to keep abreast with modern exploration. He writes well and gives all essential details, with sketch maps that make the routes followed plain to his readers, and 16 half-tone plates reproduce photographs actually taken during the expeditions.

"Weather Rambles"

By W. J. HUMPHREYS, C.E. Ph.D.
(Bailliere, Tindall and Cox. 11/6 net)

This fascinating book is not a mere text book, full of technical details; instead it justifies its name because the author rambles hither and thither through the realm of science, giving his readers interesting accounts of the wonders of rain, frost, dew, clouds and sunshine. Each chapter is a little article in itself, in which some interesting corner of the world's weather is thoroughly explored. For instance, in the first he tells us some of the remarkable things that tornadoes have done, such as picking up locomotives and setting them down on other tracks, driving straws through the trunks of trees, wrecking buildings and carrying roofs 50 miles away.

Other chapters deal with such topics as what would happen if Greenland's ice should melt and the water produced should swell the oceans to above their normal level; how the Earth got its atmosphere; and the fall in the temperature of the Earth that would follow if the stars were blotted out. Rain figures prominently in these stories. We learn where it comes from and are surprised to learn that every second about 16 million tons fall on the Earth.

These and many other stories are told admirably. The information given is exact and reliable, and every reader will find it attractive. There are many excellent illustrations of ice, snow and rain scenes, together with portraits of men who have helped to clear up our weather problems.

"Strange Insects and Their Stories"

By A. HYATT VERRILL. (Harrap. 10/6 net)

No living creatures are more interesting than insects, many of which have ways that are so amazing as to be almost incredible. Their achievements indeed cause us to wonder whether they do not possess real intelligence and reasoning power of a high order; and our wonder is increased on reading Mr. Verrill's account of the behaviour of the many strange insects with which he deals in his book. These are important as well as interesting, for among the 300,000 and more species known are to be found Man's greatest foes and his firmest friends. Many fearful diseases are transmitted by certain insects, and we are continually waging war on others that threaten to destroy crops of all kinds. Yet without ants the Earth would swarm with grubs to such an extent that agriculture would be impossible. We depend on bees and other insects for the setting of fruit, and indeed without insects we could scarcely survive.

Every page of this book brings some new wonder of the insect world to its readers, and it is impossible to give even the slightest idea of the amazing wealth of information to be found in it. We read of insect carpenters, weavers, basket makers, engravers and bridge builders, insects that fire gas bombs and others that play hide and seek, carry lanterns and spend their lives as undertakers. Stories also are told of an insect that destroys whole forests in Central and South America, and of others that are pirates and hunters, including ogres of the insect world that continually prey on their fellows.

The most remarkable of all insects are the ants. These are organised as well as any human community, and even have hospitals for the sick, with nurses and doctors who actually amputate broken limbs. They keep herds of cattle in the form of aphides, sow the seeds of plants that grow for food, and keep small beetles as pets. Pages could be filled with stories of ants, and those who read the chapter in Mr. Verrill's book that is devoted to their activities will be sorry when they reach the end.

The practical side of interest in insects is not neglected, for Mr. Verrill includes a valuable chapter on how to find insects and preserve them. His book is well illustrated with four full-page black and white illustrations and over 100 drawings in the text, in addition to a coloured frontispiece.

"The Unveiling of Arabia"

By R. H. KIERNAN. (Harrap. 12/6 net)

For centuries Arabia has been a land of mystery that from time to time has attracted curious and eager travellers. Our knowledge of the country and of its strange inhabitants has grown slowly but steadily, and since the Great War, when the romantic exploits of T. E. Lawrence aroused so much interest, extensive explorations have revealed many strange stories to us. This full account of Arabian travel from the earliest times to the present day is therefore welcome as a record of daring adventure in forbidden and often dangerous lands.

Who first lived in the Arabian wilderness is not known, but the Bedouin who now inhabit it probably came from Yemen in the south, and spread northward as the population of that productive land increased. The first explorers were Egyptians, and after them came Phœnicians, Greeks and Romans, spurred on by stories of wealth in the southern deserts and mountains. For centuries the country was then undisturbed by visitors from the West, but in the 15th century there began the great expansion that led to the discovery of America in the West, and to the voyages of the Portuguese round South Africa to India and the East. From that time explorers and travellers became more frequent.



Bedouin of the Hejaz. From "The Unveiling of Arabia," reviewed on this page.

The first known Englishman to visit the Holy Cities of Mecca and Medina was Joseph Pitts, who while still a boy was captured at sea by an Algerian pirate, and as a slave pretended to become a Moslem. Later explorers were many, but so hostile were the Arabs to intruders of other races and religions that practically all were compelled to disguise themselves in order to penetrate into the country. Some of them were poisoned, or killed during raids by nomad Arabs, but the land continued to attract curious travellers. Such men as Sir Richard Burton, the famous explorer who with Speke discovered the Great Lakes of Central Africa, Pelgrave and Doughty penetrated far into the country and wrote thrilling accounts of their travels amid dangers of all kinds.

Since the War the great exploits of Bertram Thomas and H. J. Philby have brought to our knowledge the vast deserts in the centre and south of the peninsula. Before they ventured into the region known as the Empty Quarter, it was one of the largest unexplored areas on the face of the Earth.

Mr. Kiernan misses none of the excitements and dangers encountered by the explorers whose exploits he describes, illustrations and 12 maps included in his book add greatly to its interest and value.

"The Trail Blazers of Science"

By MARTIN GUMPERT. (Funk and Wagnalls. 10/6 net)

This book is suitable for the older reader and will appeal to all who are interested in the contribution of scientists to human knowledge. It gives the stories of ten pioneers of science, some of whose names have been partly forgotten in the interest aroused by the wonderfully swift advances of recent years. Among these are the physicians, Vesalius, the founder of anatomy, and Servetus, the famous scientist of the 16th century who first realised that the blood circulated through the lungs. Others included are Wolff and Lamarck, pioneers of evolution, and Mayer, who discovered the law of conservation of energy. The last figure is Dr. Harvey Cushing, the brilliant American surgeon who has achieved miracles in operations on the brain, and every one of the ten can fairly be described as titanic.

Each of the scientists whose stories are told was distinguished by his devotion to some special scientific idea. In many instances this was too novel and startling for the times, and its originator had to fight and suffer for his enterprise. In the brief biographies the growth of each idea is traced. At the same time we are given interesting glimpses of the daily lives of the men themselves, as well as of their scientific work, and the author conveys to his readers all the colour and drama of the achievements of his heroes.

"Aeroplanes and Aero Engines"

By P. H. SUMNER. (Technical Press Ltd. 15/- net)

Those who wish to learn as much as possible about aeroplanes and aero engines cannot do better than read Captain Sumner's book, now in its second edition and completely brought up to date, for it covers the entire subject concisely but accurately.

Captain Sumner begins with a historical chapter bringing the story of the aeroplane down to the War period. Then he turns to the principles on which flight is based, explaining how lift is obtained, and the effect of streamlining and of various forms of wing sections. In doing so he introduces many technical terms that are becoming familiar to all of us and gives their exact meaning. The airscrew next claims attention, and then the author turns to the engine, explaining the various parts of an engine and their work, and describing famous modern engines of all types.

The rest of the book deals with the aeroplane itself, detailing first the principal materials used in its construction and explaining how they are put together. The systems of control, and undercarriages and aeroplane floats are all carefully described, and there is an attractive chapter on the rigging of aircraft. This is followed by accounts of modern aeroplanes and their performance, in which the meanings of such terms as useful load, pay load, rate of climb and service ceiling are made clear.

The book is concisely written, and is full of information on practically every aeroplane topic, from wind tunnels and experimental work on wing forms to the performance of the latest Empire flying boats. There are over 200 drawings and half-tone illustrations that help to give readers a clear idea of the modern aeroplane and its construction.



"Canopus," the first of the Empire flying boats built by Short Bros. for Imperial Airways. Our illustration is from "Aeroplanes and Aero Engines," reviewed on this page, and is reproduced by courtesy of "Flight."

"Let's Learn to Fly"

By C. ST. JOHN SPRIGG (Nelson. 3/6 net)

This book was written by a pilot of considerable skill, with it the gift of simplifying technical information and making it attractive. In it the prospective air pilot is taken through a complete course of training. The breezy style in which the instruction is given makes the most commonplace details attractive, and helps the reader to imagine himself actually in the cockpit of a training aeroplane. In addition there are excellent chapters describing current types of air liners, Croydon wireless control and typical modern airports, and a brief survey of the great airways of the world also is given. Several excellent full-page plates and many line drawings in the text illustrate the explanations given.

In Search of New Models

A Stroll in Dockland

MODEL-BUILDERS who live near a large port, or are able to visit one while on holiday, can derive pleasure and profit from a stroll along the quays and among the warehouses of dockland. The loading and discharging of the cargoes of the vessels to be seen there is very fascinating, and the attractions of such a stroll are increased by the opportunities it gives for planning new Meccano models. The construction of these will help to relieve that usually rather boring period following the return home from summer holidays!

Ships of course form the main attraction of any port. At the larger ones many types of vessels can be seen, giving excellent opportunities of gaining sound information about the ships engaged in various trades, and the peculiarities of their design. This will be very useful later on when building model vessels. Trawlers, drifters and other fishing craft also can be seen in many instances, and these alone provide an interesting series of subjects, especially for those who possess small Outfits. A characteristic trawler fitted with a six-cylinder Diesel engine was illustrated and described on page 73 of the *"M.M."* for February 1937. Other small boats that can be built with only a few parts include tugs, life-boats, sailing dinghies and rowing boats.

At the more important docks there are warehouses containing inflammable materials such as cotton and oil seed, and in order to protect these great structures from fire, special vessels fitted with pumps and other fire fighting equipment are employed. One of the latest of these ships to be put into commission, the *"Duchess of Abercorn,"* was illustrated in the February 1937 *"M.M."*

Conspicuous objects at most modern docks are the great automatic coaling plants, which take coal from railway wagons on the quayside and discharge it into the bunkers of ships tied up alongside. Owners of large Outfits will find these coaling plants fine subjects. One good Meccano model of this kind is shown in Fig. 1. In the plant of which this is a reproduction the coal is carried to the plant by trucks, which run into an elevator cage and are lifted to the top of the tower, where they are tipped to discharge their contents into a chute leading into the ship's bunkers. The cage is raised and lowered by hydraulic rams, while the subsidiary movements are controlled by electric motors. The chute also can be raised or lowered so that it can be used to coal both large and small ships. Every possible movement is introduced into the model.

In order to prevent the coal being smashed into very small pieces by its fall, an anti-breakage device is suspended from an overhead jib, so that it hangs in front of the chute. The anti-breakage box as it is called, consists of a belt passing round rollers at each end of a rectangular framework. The belt has a number of pockets secured to it, into which the coal falls as it comes down the chute, acting like jets of water on a Pelton wheel and causing the belt to rotate. As each pocket rounds the lower end of the belt it becomes inverted, and the coal falls only a short distance into the hold. A special device of this kind is very interesting in Meccano, and in the model the pockets are formed by 2″ Flat Girders, fastened at each end to a belt of Sprocket Chain.

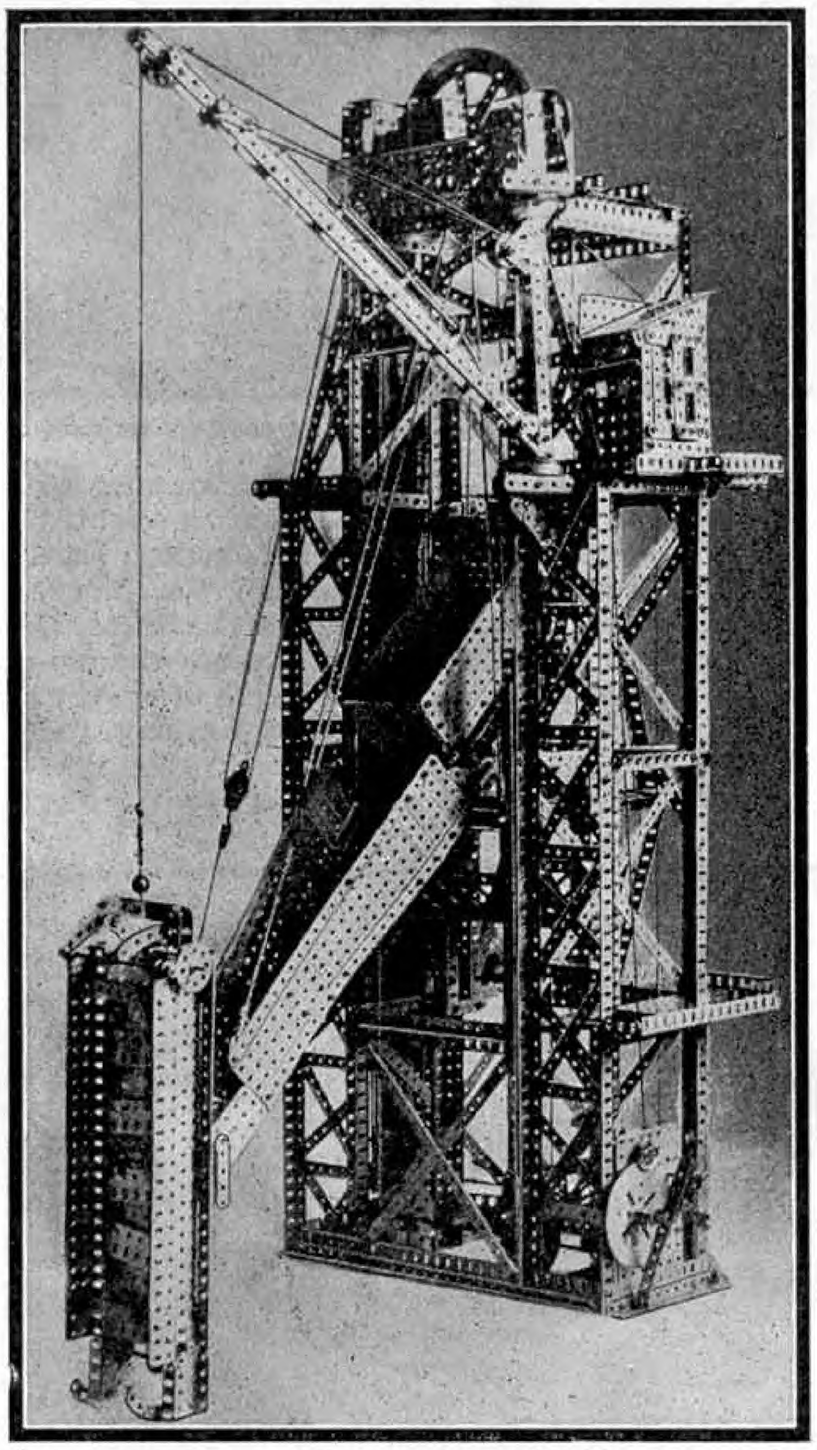


Fig. 1. A model of an automatic ship-coaler fitted with a device to break the fall of the coal into the ship's hold. It is the work of L. W. Gray, Cowes, Isle of Wight.

A model ship coaler of a different type is described in Meccano Super Model Leaflet No. 2. In this the coal is lifted by a grab and deposited in a truck that runs on rails, at the end of which there is a chute leading downwards to the ship's hold. The bottom of the truck is hinged and falls away when the truck is over the chute, thus allowing the coal to drop into the hold. Coalers of this kind, mounted on pontoons, are used in rivers where the water near the banks is so shallow that a vessel with deep draught is forced to stay well out in midstream. The coaler, accompanied by a coal barge, is towed out to the ship, and the coal is lifted by the grab, and deposited in the bunkers. This suggests a good scheme for the more ambitious model-builder reproducing a complete dock scene.

Among objects of interest to be seen in any dock area are the fussy little tank locomotives that are used for hauling goods trains and coal wagons along the quaysides. These powerful engines are quite easy to model with only a small Outfit, and several different types have already been described and illustrated in the *"M.M."*

A subject of a more unusual kind is the portable automatic luggage elevator that usually forms part of the equipment of quays where passenger ships are berthed. These are used for transporting passengers' trunks from the quay to the ship's deck, and are self-contained units, the road wheels and the conveyor belt being driven from the same Motor. A Meccano model driven by an E6 Electric Motor is shown in Fig. 3, the Motor being supplied with current by an accumulator carried in a

frame at the rear of the model. The elevator belt on which the luggage is carried, is represented by a strip of canvas, to which small pieces of wood are fixed at regular intervals.

Some docks possess a pontoon or floating crane, and readers who have a large Outfit will find such a crane a suitable subject for modelling. Pontoon cranes have become increasingly popular during the last few years on account of the ease with which they can be manœuvred close to the sides of ships or quay walls. They are used chiefly for fitting out large vessels and handling dock gates during repairs. A large square base or pontoon supports a massive superstructure and a jib, which is capable of slewing through 360 deg., and is fitted with two or even three individually controlled hoisting blocks. The Meccano Pontoon Crane (Super Model Leaflet No. 28) is a good example of a crane of this type.

Another type of crane that may be seen in dock areas during construction or repair of harbour walls is the giant block-setting crane, a fine example of which is illustrated on the cover of the Meccano Manuals of Instruction. Cranes of this kind usually are capable of lifting solid blocks of concrete weighing anything up to 100 tons. The jib is of the horizontal type, and the movements of the crane include travelling, rotating, hoisting and lowering of the load and traversing of the hoist trolley, all of which are controlled from a cab situated at the rear of the jib. The blocks of concrete are gripped by an interesting mechanism known as Fidler's block-setting gear, which itself provides a good subject for those whose stock ot parts is limited.

For hauling heavy loads from one part of the docks to another, special travelling cranes are used, and one of these is the prototype of the model illustrated in Fig. 2. This model is based on an actual crane in service at the Southampton Docks. The jib is of very strong construction, and when under load is balanced by 100 tons of concrete slung under the rear of the cab. The entire superstructure of the crane rotates on a turntable, the diameter of which is 30 ft. and the height 8 ft. Power is supplied by five electric motors housed within the superstructure, two of them being used for operating the lifting mechanism, while the remaining three are used for slewing, luffing and travelling, respectively. In the Meccano model a gearbox is included in order to allow all five movements to be carried out from one Motor placed inside the cab. This involves no loss of realism in the movements and a similar plan can be followed with advantage with other models.

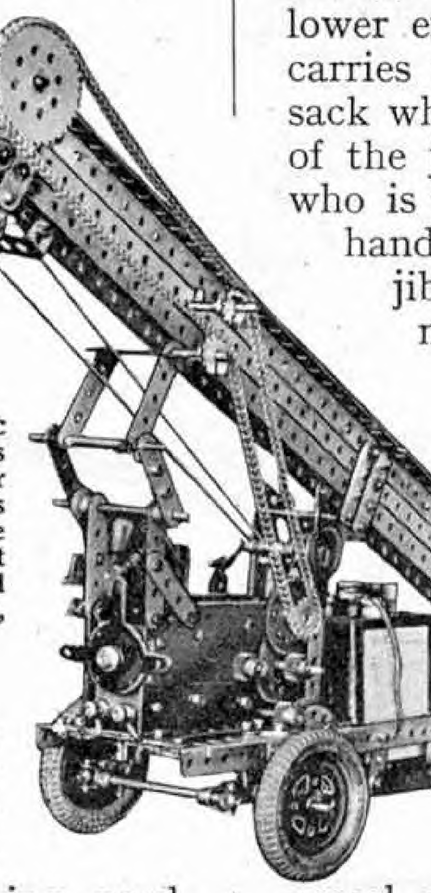


Fig. 3. An automatic conveyor such as is used on quays for lifting passenger's luggage on to the decks of ships. It was designed and built by J. Isakson, Oslo.

Model-builders who have the necessary parts at their disposal could spend many pleasant hours in constructing a model warehouse, complete with automatic lifts. The lifts should be arranged to work alternately if there are two or more of them, and to start and stop at each floor without supervision. A model of this kind is described in Instruction Leaflet No. 31. It is fitted with two lifts, each equipped with a novel safety device for preventing the lift from falling to the bottom of the shaft in the event of the winding rope breaking. The lifts are driven from a single Electric Motor, which can be controlled from any floor of the warehouse.

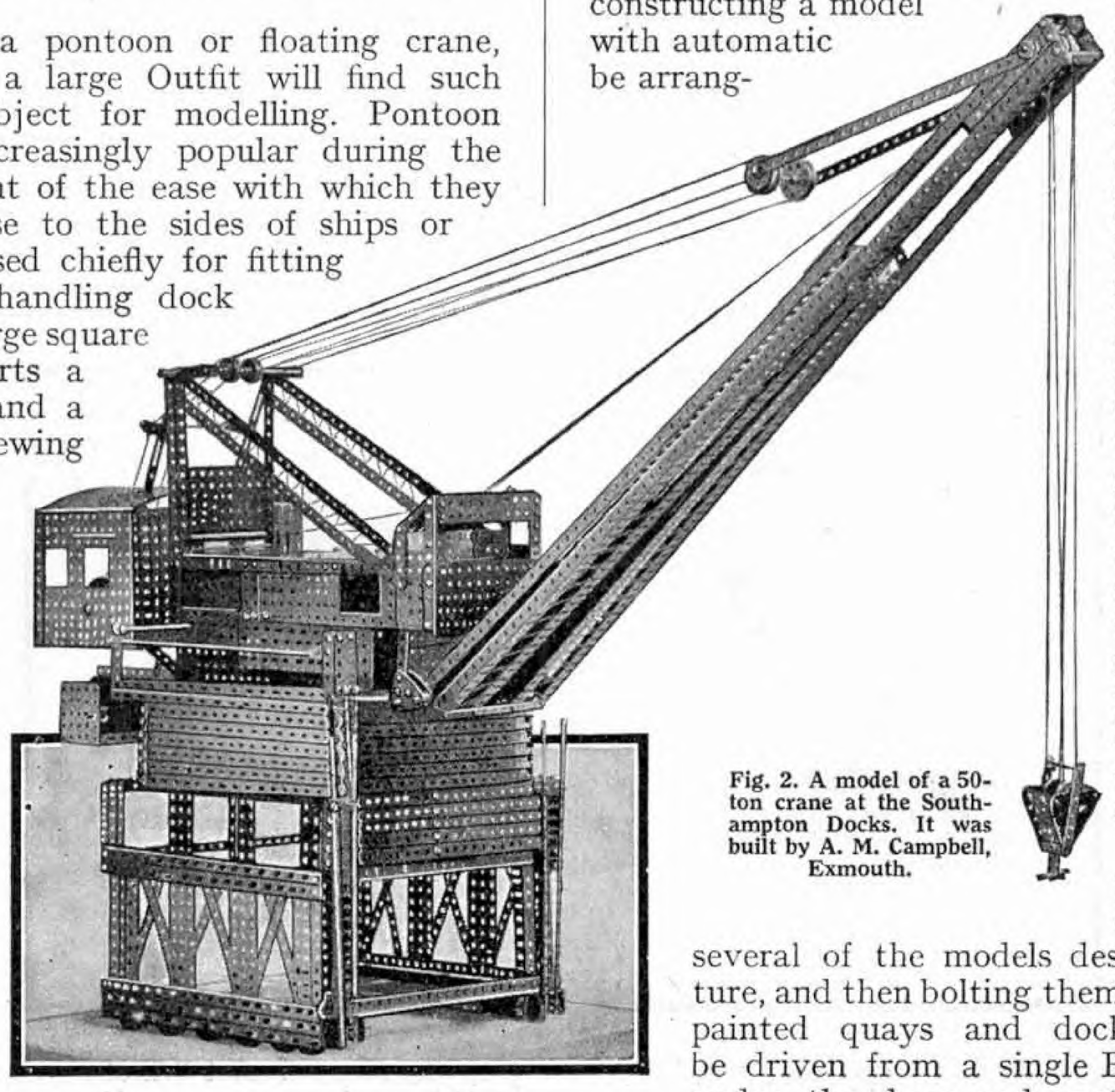


Fig. 2. A model of a 50-ton crane at the Southampton Docks. It was built by A. M. Campbell, Exmouth.

An interesting display model could be constructed by building several of the models described above in miniature, and then bolting them to a baseboard bearing painted quays and docks. The models could be driven from a single Electric Motor concealed under the base and controlled by a "penny-in-the-slot" mechanism.

When a ship carrying a load of grain packed in bags comes into dock the bags are first transferred from the ship on to the quay by the ship's own derricks. A machine called a "stacker" is then sometimes used to lift the sacks on to lorries, which carry them to the warehouses. The stacker consists of a small wheeled truck, on which a jointed jib, pivoted at its lower end and also at its centre, is mounted. The jib carries two jaws at its upper end, and these grip the sack while it is lifted on to the lorry. The movements of the jaws and the jib are controlled by an operator who is seated at the rear of the truck, the power for handling the stacker and also for operating the jib and jaws being provided by a single electric motor. An illustrated description of a stacker of this kind appeared on page 177 of the *"M.M."* for March 1936.

Other items of dock equipment that make excellent subjects for model-builders are electric trucks, winches, boat lowering gear and automatic extending and retracting gangways of various types.

Often during a walk round the docks one is fortunate enough to see a diver at work, accompanied by his service boat. A vessel of this kind makes an interesting and unusual subject for the model-builder and it is quite easy to obtain a realistic effect. Among the special equipment of these vessels is an air pump that is operated usually either by manual or electric power, and a metal ladder that extends over the side into the water for the use of the diver when leaving or boarding the vessel.

Meccano Suggestions Section

By "Spanner"

(383) Villiers Two-Speed Gear (W. Lowe, Chester)

Several types of variable speed gears are in use on bicycles and each has its good points, such as ease of operation and simplicity. One type that is popular is the Villiers two-speed device. This employs an ingenious method for obtaining an additional gear ratio, and was described and illustrated in the *"Our Busy Inventors"* pages of the *"M.M."* for July 1935. The Meccano model fully demonstrates the principle on which the actual mechanism is based. It is shown in the illustrations on this page, mounted on a framework built from two 12½" Angle Girders joined across at each end by 5½" Angle Girders. Two 5½" × 2½" Flat Plates are bolted in the positions shown, the rear one carrying the two-speed mechanism and the other carrying the driving Sprocket Wheel.

Fig. 383

Bearings for the layshaft are supplied by the rear 5½" × 2½" Flat Plate and two 5½" Strips bolted together. The 5½" Strips are carried on 2" Strips bolted to Trunnions. A 1½" Corner Bracket bolted to the 5½" Strips forms a bearing for 4½" Rod 1. The 4½" Rod is the driven shaft, and carries a 3" Pulley which represents the rear wheel of the cycle. A 2" Sprocket Wheel 2 is fitted with a built-up free wheel unit (Fig. 383a). Two Angle Brackets 3 carried on lock-nutted Bolts and tensioned by short lengths of Spring Cord form the ratchets, and they engage with the teeth of a ¾" Pinion 4 fastened on Rod 1 as shown. Next to Sprocket Wheel 2 is a 1½" Sprocket Wheel 5, which is secured on Rod 1 by its grub screw. The Rod is retained in place in its bearings by two Collars.

The layshaft is represented by a 3½" Rod and is journalled in the rear 5½" × 2½" Flat Plate and in the 5½" Strips. It carries a 1½" Sprocket Wheel 6 that is free to turn on the layshaft. Next to it is a built-up free wheel unit, which is shown in parts in Fig. 383a. Two Spring Clips are carried on two lock-nutted ⅜" Bolts 9 and engage with the Ratchet Wheel 7 fastened on the layshaft. There is a Compression Spring 10 on the layshaft, and also a built-up dog, which consists of two 1½" Rods 11 held by Collars in the holes of a Bush Wheel. Between the Bush Wheel and the 5½" Strips is an Angle Bracket that is lock-nutted on the bolt 14 to one arm of a Simple Bell Crank 12. The Bell Crank is pivotally attached by a lock-nutted bolt 13 to an Angle Bracket, which is bolted to the centre holes of the 5½" Strips. A short length of Wire Line 15 is attached to the free arm of Bell Crank 12 and passes over a ½" loose Pulley on a 1" Rod which is held in place in a Single Bent Strip by Spring Clips. The other end of the Wire Line is attached to a gear changing lever as shown.

A ¾" Sprocket Wheel is carried on a Pivot Bolt 16 lock-nutted to a 1" Corner Bracket, which is bolted to the rear 5½" × 2½" Flat Plate. This is a jockey Sprocket and is used to give good engagement over a wide arc between the driving chain and the fixed wheel on the layshaft. The main gear wheel is represented by a 3" Sprocket Wheel carried on a 1½" Rod, which is passed through the front 5½" × 2½" Flat Plate and is retained by a Collar in the centre hole of a Double Bent Strip. The driving Sprocket Chain 18 is taken from the 3" Sprocket Wheel, over the Sprocket Wheel 2, around Sprocket Wheel 6, and over the jockey Sprocket Wheel 1. The remaining Sprocket Wheels 5 and 8 are connected by a short length of Sprocket Chain.

In Fig. 383 the device is shown in low gear, when the drive is taken to Sprocket Wheel 2 and Sprocket Wheel 6 rotates idly on the layshaft. When the gear lever is moved forward the Bell Crank pushes the Angle Bracket inward. This movement causes the 1½" Rods 11 on the Bush Wheel to slide so that they engage with holes in Sprocket Wheel 6, connecting it with Sprocket Wheel 8. The drive is now transmitted through both Sprocket Wheels 8 and 5, the latter overrunning the free wheel on Sprocket Wheel 2 and thus taking the drive to the 3" Pulley, giving top gear. The Compression Spring returns the mechanism to low gear when the gear change lever is released.

Any size of Sprocket Wheels may be used to give various ratios, but it should be remembered that Sprocket Wheel 5 should be smaller than Sprocket Wheel 2 so that there is an over-running action between the two Sprocket Wheels when the mechanism is in top gear.

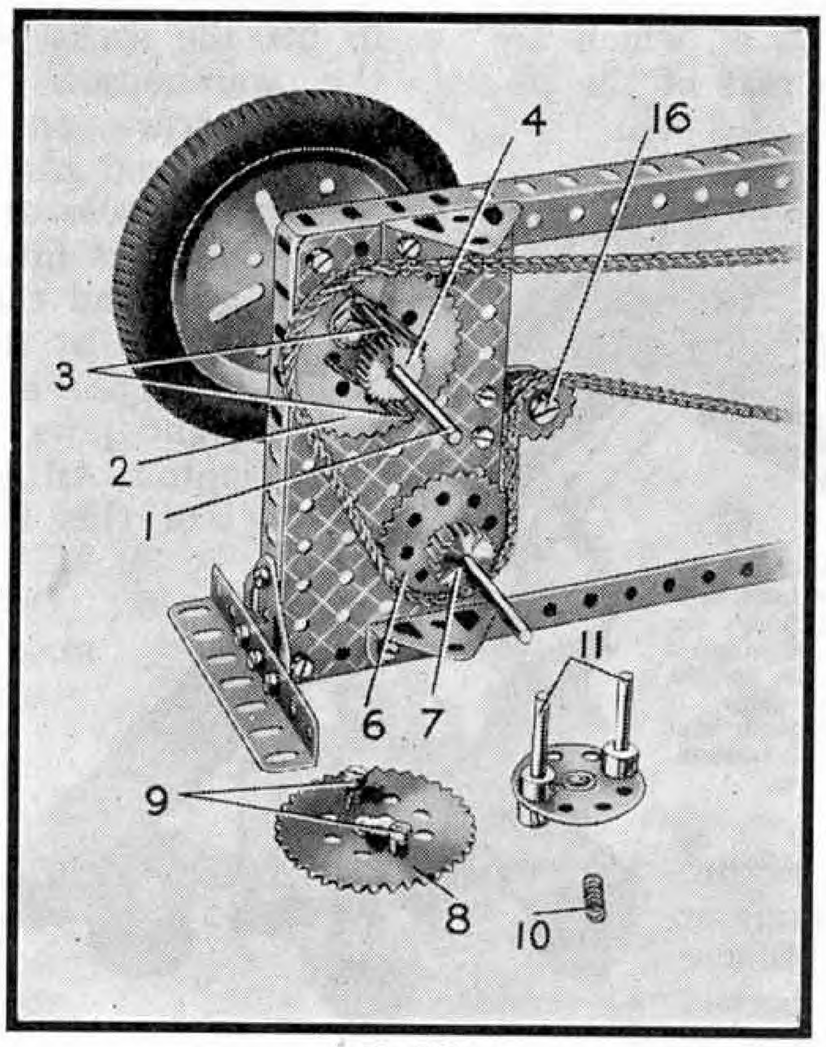


Fig. 383a

(384) Meccano Micrometer

(T. Richmond, Manchester)

A practical micrometer that will measure small objects with a surprising degree of accuracy was recently submitted by T. Richmond, Manchester.

The instrument consists essentially of a 2" Screwed Rod fitted with a Bush Wheel, two 1½" Rods, a 2" Rod and four Couplings. The Rods are held in the Couplings, and are arranged in the form of a U, and the 2" Screwed Rod is screwed into the top transverse bore of one of the Couplings. A stop is provided by a bolt in the opposite Coupling. A disc of cardboard is bolted to the Bush Wheel and eight divisions are marked off around its circumference. A Strip is arranged so that it provides a fixed point in reference to the divisions on the scale.

The Screwed Rod moves through .031 in. when it is rotated through a complete revolution. The distance the Rod moves during a fraction of a revolution is shown by the scale on the Bush Wheel.

The article to be measured is placed against the stop, and the Bush Wheel is rotated until the end of the Screwed Rod just touches the object. The scale position is noted and the Bush Wheel is rotated until the Screwed Rod comes into contact with the stop, care being taken to count the number of complete revolutions made by the Bush Wheel.

For example, if the Bush Wheel requires 24½ rotations before the Screwed Rod makes contact with the stop, the object is .7595 in. in width (24.5 × .031).

(385) Retractable Undercarriage

(B. Scaife, Lowestoft)

Retractable undercarriages are now fitted to most modern high-performance aeroplanes. Until recently they usually were fitted only to low-wing monoplanes, but a special form of the device suitable for high-wing machines and biplanes has now been developed and is fitted as standard equipment to several of the latest United States naval fighting aeroplanes. In this mechanism the wheels retract into wells in the sides of the fuselage, which is deepened specially for the purpose.

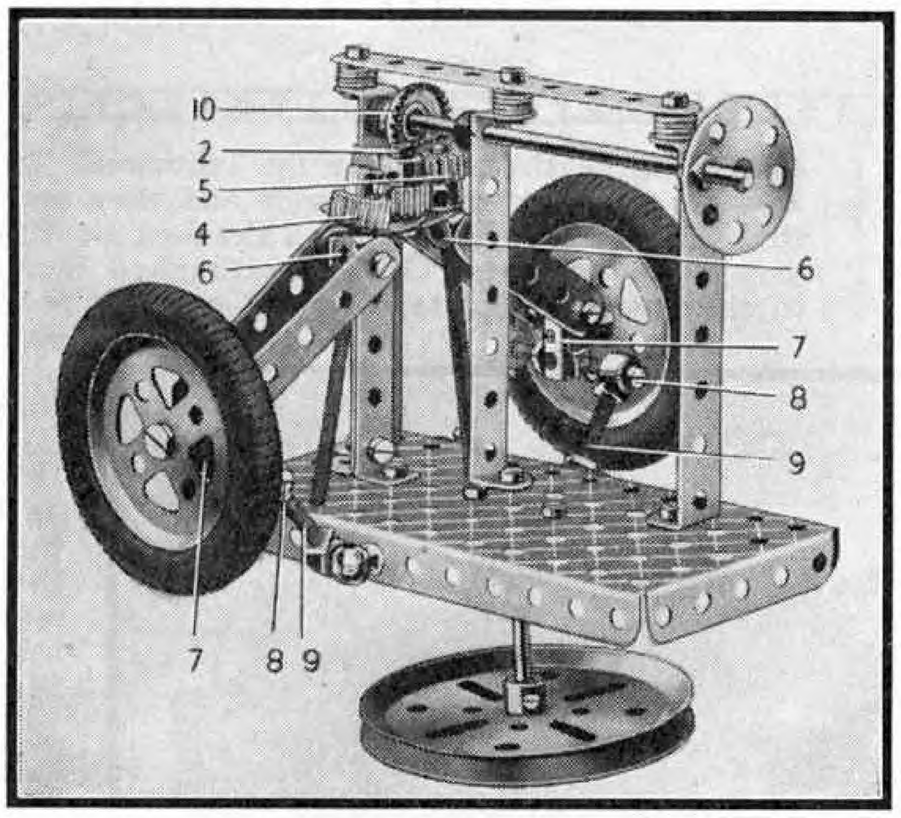


Fig. 385

The principal part of Scaife's Meccano mechanism is shown in Figs. 385 and 385a mounted on a special stand so that it can easily be demonstrated. Three $3\frac{1}{2}'' \times \frac{1}{2}''$ and two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips are bolted back to back and the front one is connected to the front $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip by a right-hand Corner Angle Bracket 1. A $\frac{3}{4}''$ Bolt 2 carries a $\frac{1}{2}''$ Pinion and is lock-nutted to the $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, two Flat Brackets being carried on the Bolt between the lock-nuts. $3\frac{1}{2}''$ Screwed Rods 3 are fitted with $\frac{1}{2}''$ Pinions 4 and 5, and are passed through holes in the Flat Brackets and in the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate.

The Screwed Rods are retained in position below the Flanged Plate by Collars. Each carries a "spider" 6, taken from a Universal Coupling, and $2\frac{1}{2}''$ Strips are pivoted on Bolts lock-nutted in the unoccupied threaded holes on the "spider." At their free ends the $2\frac{1}{2}''$ Strips are fastened to Couplings 7, which have $\frac{3}{4}''$ Bolts 8 lock-nutted to them. The 1" Screwed Rods 9 have Collars lock-nutted at each end in their tapped holes. The Collars are pivoted on the shanks of the $\frac{3}{4}''$ Bolts 8, and also on the shanks of $\frac{1}{2}''$ Bolts locked in Handrail supports that are bolted to the flanges of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The 2" Pulleys representing the landing wheels are fitted with Rubber Tyres, and are carried on Pivot Bolts screwed into the centre tapped holes of the Couplings.

The $\frac{3}{4}''$ Contrate Wheel 10 is fastened on a $4\frac{1}{2}''$ Rod and meshes with the $\frac{1}{2}''$ Pinion 5. When the handwheel is rotated the "spiders" are caused to traverse the Screwed Rods 3, and the 2" Pulleys retract into the position shown in Fig. 384a.

The mechanism is carried on a 2" Rod held in the boss of a Double Arm Crank bolted underneath the Flanged Plate, and also in the boss of a 3" Pulley.

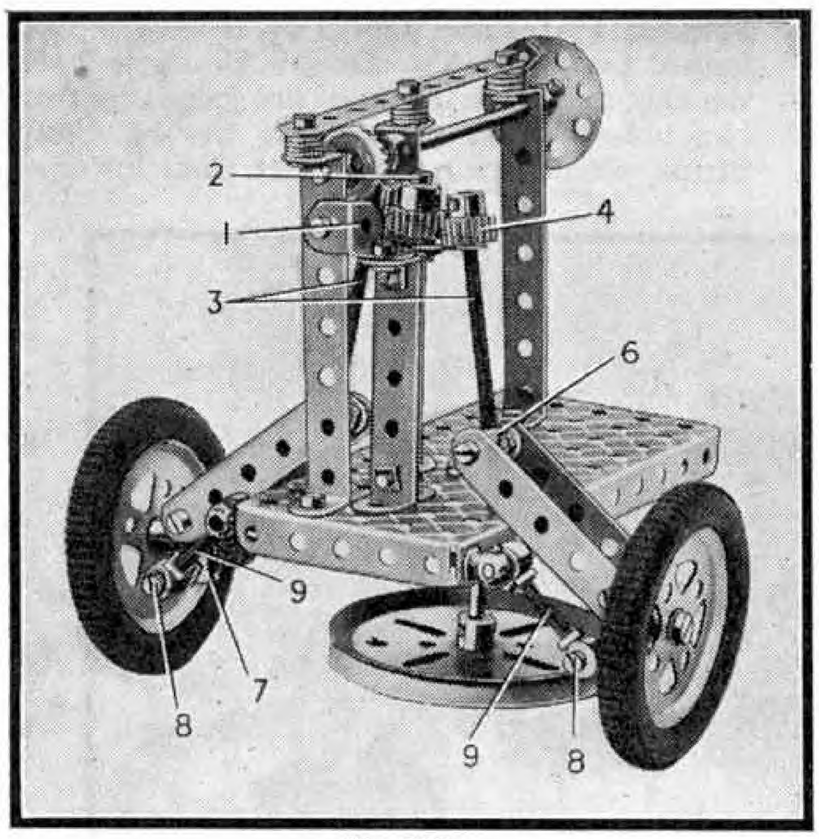


Fig. 385a

(386) Retort Stand

(T. Sullivan, Neath)

Owners of Kemex Outfits will find a retort stand submitted by T. Sullivan, Neath, a useful accessory when conducting experiments.

The stand consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a Crank carrying an $11\frac{1}{2}''$ Rod in its boss. The lower clamp is made by bolting a $1\frac{1}{2}''$ Pulley to two Couplings, the securing Bolts carrying two Washers on their shanks for spacing purposes. Its jaws are $1'' \times 1''$ Angle Brackets, one attached by an Obtuse Angle Bracket and the other by a Hinge to a large Fork Piece held on a 1" Rod locked in the boss of the $1\frac{1}{2}''$ Pulley. A short length of Spring Cord holds the jaws together.

An alternative design of clamp is shown in the same illustration. The construction is similar, but the jaws are extended by two Obtuse Angle Brackets and a $\frac{3}{8}''$ Bolt is lock-nutted to one of them. The Bolt carries a Compression Spring between the Obtuse Angle Brackets, and the jaws may be opened or closed by turning the Threaded Boss. Bolts are screwed into the Couplings so that they may be fastened on the $11\frac{1}{2}''$ Rod, but Wing Screws, Kemex Part No. K42, may be used to facilitate adjustment.

(387) A Neat Ball Bearing Unit

(R. Brookes, Bournemouth)

Many model-builders who possess small Outfits often find that models having swivelling superstructures with 3" Pulleys as bearings will not turn easily owing to friction. A novel ball bearing unit for which many uses can be found in small models was submitted recently by R. Brookes, of Bournemouth. A Wheel Flange is bolted to a 3" Pulley so that the boss of the Pulley passes through the centre hole of the Wheel Flange. Steel Balls are then placed round the rim of the Pulley, a second 3" Pulley is fitted on top, and a Rod is passed through the bosses of the Pulleys.

The rod is secured in the lower Pulley.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

M.197. Model-builders who do not possess $\frac{7}{8}''$ Bevel Gears and who wish to transmit the drive from one shaft to another at right angles will find a novel method of obtaining a right angle drive submitted by J. Leyton, Cambridge, very useful. Nuts and Bolts are fitted in the holes of two Bush Wheels, which are mounted on the Rods it is required to drive in such a manner that the ends of the Bolts on them engage in a similar manner to the teeth of two Gears.

The gear ratio provided is 1 : 1 and is equivalent to using two $\frac{7}{8}''$ Bevel Gears. In addition, this method of driving two shafts at right angles is much more satisfactory than the ordinary friction drive.

M.198. The Meccano Flywheel (Part No. 132) has a ribbed groove cut in its periphery to enable it to be used in conjunction with Spring Cord. When a reduction ratio is required it becomes necessary to use the small Pulleys, but a certain amount of slip takes place between the Pulley rims and the Spring Cord, making it difficult to transmit a powerful drive. E. James of Ramsgate successfully overcomes this trouble by using the various sizes of Bevel Gears butted together so that they form grooved pulleys. The teeth of the Bevel Gears provide sufficient grip for the Spring Cord.

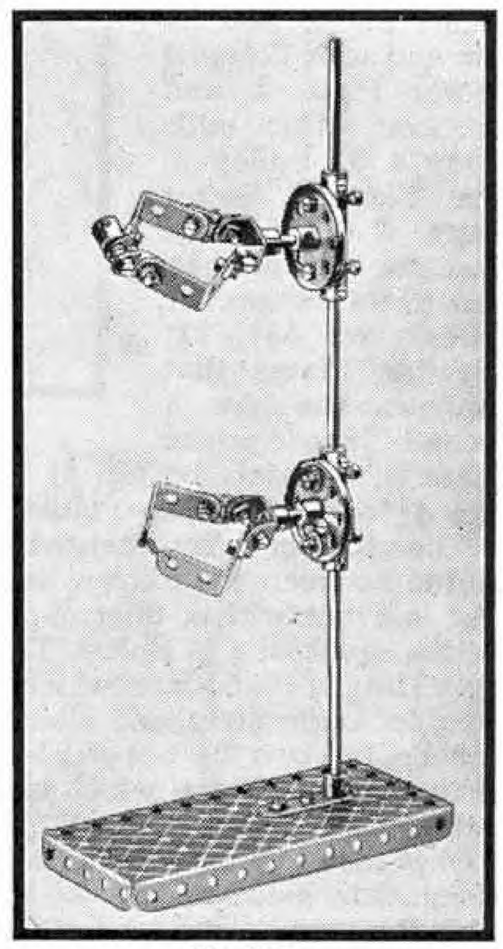


Fig. 386

M.199. In models of roundabouts, swing bridges or similar large rotating structures it is necessary to incorporate reduction gearing in order to operate them at speeds in conformity with those of their prototypes. Worm gear is generally used for this purpose because it provides a neat and compact arrangement, but it has certain disadvantages when used in models of this kind. For example, when the driving Motor is stopped the structure continues to rotate owing to its momentum, and considerable strain therefore is imposed on the moving parts and bearings, with the result that the Gears become loose on their shafts. The trouble is due to the fact that the Worms become locked when they are not driving.

H. Blea of Londonderry, found that this trouble could be overcome by incorporating a free wheel unit. His model was a swing bridge, and the unit was mounted on the driving shaft of the bridge. The driving Motor could then be stopped just before the bridge reached its normal position.

New Outfit Models

Road and Rail Vehicles for Small Outfits

THIS month we are describing an articulated lorry, a railway breakdown crane, a traction engine and an electric truck built with Outfits C, D, F, and A, respectively. Although they are all simple in design each model includes sufficient details to make its construction interesting and worth while.

The lorry is fitted with a No. 1 Clockwork Motor and is illustrated in Fig. 1. Construction of the model is commenced by building the chassis on which the cab and bonnet are mounted. Two $5\frac{1}{2}$" Strips are bolted at one end to a Flanged Sector Plate 2, and at their other ends carry a 3" Pulley 3. The Flanged Sector Plate 2 forms the base for the bonnet, and to its flanges are bolted two $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates that represent the sides. A second Flanged Sector Plate is used for the top of the bonnet, and is supported by the two $4\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates.

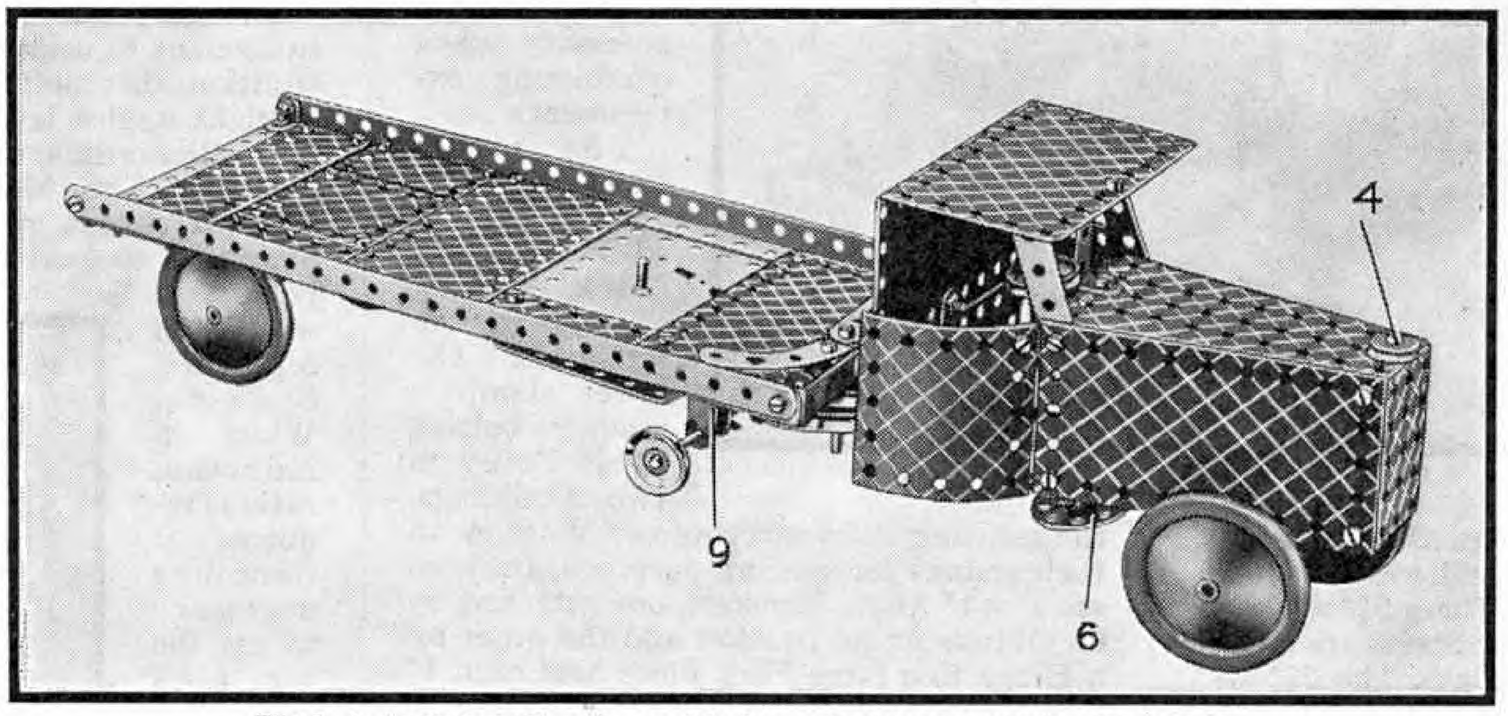


Fig. 1. A simple but attractive model of an articulated lorry built with Outfit C.

The radiator is represented by a $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flanged Sector Plate, bolted between the narrow ends of the two Flanged Sector Plates, and is fitted with a filler cap consisting of a $\frac{1}{2}$" loose Pulley held on the shank of a $\frac{3}{8}$" Bolt 4. The top and back of the cab are formed by a Hinged Flat Plate, which is secured to the bonnet by a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, and also to two Angle Brackets bolted to the chassis by two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates 5. Each door is a $1\frac{11}{16}"$ radius Curved Plate, which is secured to the sides of the bonnet by two Obtuse Angle Brackets. A 1" Pulley fixed on the end of a $3\frac{1}{2}"$ Rod is used for the steering wheel. The $3\frac{1}{2}"$ Rod is journalled in the elongated hole of a Flat Bracket bolted to the upper Flanged Sector Plate, and also in a hole of the Sector Plate 2. The Rod carries a Bush Wheel 6 at its lower end.

Each of the front Road Wheels is carried on the shank of a $\frac{3}{8}$" Bolt, which is passed through the round hole of Angle Bracket 7. The two Angle Brackets 7 are then pivotally attached by means of lock-nutted $\frac{3}{8}$" Bolts to two more Angle Brackets fastened to the bonnet. The locknuts also fix a Flat Bracket to each of the Angle Brackets. A $2\frac{1}{2}$" Strip is secured to the two Flat Brackets, as shown in Fig. 2, one of the Bolts carrying also the $3\frac{1}{2}$" Strip 8, which is fastened at its other end to the Bush Wheel 6.

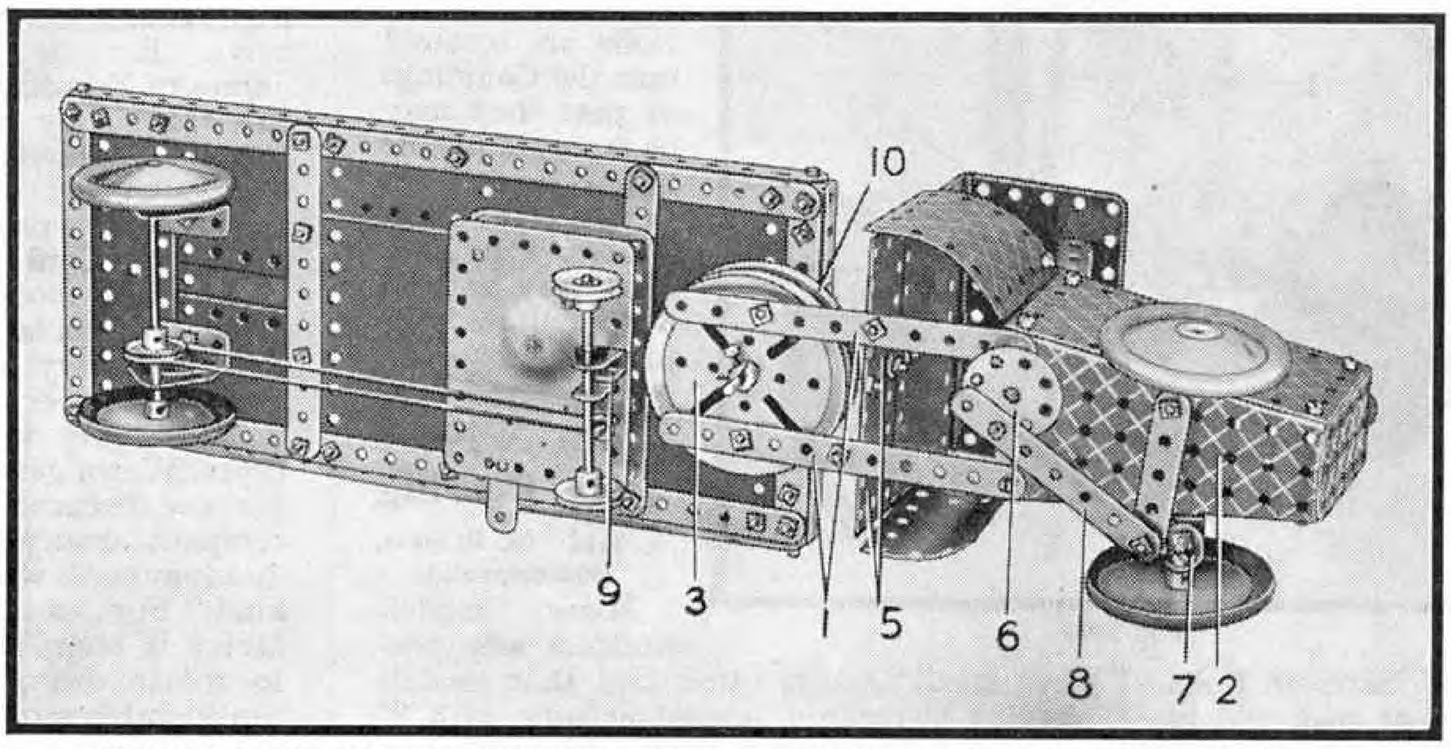


Fig. 2. An underneath view of the lorry, showing steering gear and method of fitting the Motor.

The platform of the trailer is made by joining two $12\frac{1}{2}"$ Strips at their ends by $5\frac{1}{2}"$ Strips, and then filling in the frame thus formed with Flexible Plates of various sizes. The No. 1 Clockwork Motor is secured under the trailer so that the winding spindle projects upwards, and the drive is taken from the shaft of the Motor to a 1" Pulley on the back axle. The latter is a $3\frac{1}{2}"$ Rod journalled in the holes at the narrow ends of two Flat Trunnions, which are fixed underneath the trailer by Trunnions. Two 1" Pulleys are used for the front trailer wheels and they are secured on a $3\frac{1}{2}"$ Rod, which is passed through a Cranked Bent Strip 8 and is held in position by Spring Clips. The Cranked Bent Strip 8 is bolted to the lower side plate of the Motor, but is spaced from it by washers.

A 3" Pulley 10 is bolted at the front of the trailer, and a $1\frac{1}{2}"$ Rod is held in its boss. The Rod is then slipped through the 3" Pulley 3 at the rear of the cab, and held securely by a Spring Clip.

Parts required to build the Articulated Lorry: 4 of No. 1; 6 of No. 2; 1 of No. 3; 5 of No. 5; 3 of No. 10; 2 of No. 11; 8 of No. 12; 2 of No. 16; 1 of No. 18a; 2 of No. 19b; 4 of No. 22; 1 of No. 23; 1 of No. 24; 6 of No. 25; 67 of No. 37; 6 of No. 37a; 6 of No. 38; 1 of No. 44; 1 of No. 48; 2 of No. 48a; 1 of No. 51; 2 of No. 54a; 2 of No. 90a; 6 of No. 111c; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 186; 2 of No. 187; 2 of No. 188; 2 of No. 189; 3 of No. 190; 2 of No. 191; 2 of No. 192; 1 of No. 198; 2 of No. 199; 1 No. 1 Clockwork Motor (not included in Outfit).

Fig. 4 shows the neat model traction engine built with Outfit F. In building it a Flat Trunnion 1, fitted with two $5\frac{1}{2}"$ Strips, is bolted to each side of a Boiler, in the positions shown in the illustration. The $5\frac{1}{2}"$ Strips provide support for two $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates that form the sides of the cab. The rear flanges of the $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates are joined by two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates overlapped two holes. Two Double Brackets 2 are bolted to the back of the cab, and their free ends are joined by two $1\frac{1}{2}"$ Strips overlapped two holes. The Bolts holding the $1\frac{1}{2}"$ Strips carry also two $2\frac{1}{2}"$ Strips, which are bent so that their lower ends touch the bottom of the cab.

The cylinder 3 of the engine is a Channel Segment that is bolted in position four holes from the front of the Boiler. It is fitted with a piston rod consisting of a $1\frac{1}{2}"$ Rod, and this slides in the elongated holes of two Angle Brackets bolted inside the cylinder. The piston rod is attached pivotally by a Collar to a $2\frac{1}{2}"$ Strip, the free end of which is fastened by lock-nutted Bolt 4 to a Bush Wheel mounted on the end of a $1\frac{1}{2}"$ Rod. The Rod is journalled in a Cranked Bent Strip 5 fastened to the side of the cab by an Angle Bracket, but spaced from the Bracket by washers. The $1\frac{1}{2}"$ Rod carries on the inner side of the Cranked Bent Strip a 1" Pulley 6, and to the outer end of the Rod a 1" Pulley 7 is secured. The Pulley 7 is connected by a Driving Band to another 1" Pulley on the back axle, so that the piston rod is set in motion when the wheels are turned.

Two $1" \times 1"$ Angle Brackets 8 are fastened by a Flat Bracket to the front of the Boiler, and a 2" Rod is journalled in their ends. Between the Angle Brackets the Rod carries two $\frac{3}{4}"$ Flanged Wheels to represent a dynamo, washers being used as packing

pieces. The Rod bears a ½″ Pinion at one end, and a ½″ loose Pulley and a Collar at the other. The ½″ Pulley is connected by a Driving Band to the Pulley 6.

The bearings for the front axle, a 3½″ Rod, are provided by a 1½″ × ½″ Double Angle Strip, which is attached by a lock-nutted Bolt to the underside of the boiler. Cord is attached to one end of the Double Angle Strip, wound around the 2″ Rod 9, and finally tied to the other end of the 1½″ × ½″ Double Angle Strip. The Rod 9 is held by a Collar and a ½″ Pinion 10 in the ends of a second 1½″ × ½″ Double Angle Strip. The Pinion meshes with a Worm on the end of a 3½″ Rod, which is journalled in a Double Bracket bolted to the side of the cab and carries at its upper end a fast Pulley that forms the steering wheel.

The canopy is made by bolting two 4½″ × 2½″ Flexible Plates and two 5½″ × 2½″ Flexible Plates to a framework consisting of twin compound strips joined at each end by a 3½″ Strip. Each of the compound strips comprises two 5½″ Strips overlapping three holes. The canopy is supported by means of 2½″ Strips. Two Chimney Adaptors are fixed, one under the canopy and the other over it, to form a realistic chimney. A Sleeve Piece 11 is slipped on the end of the lower Chimney Adaptor.

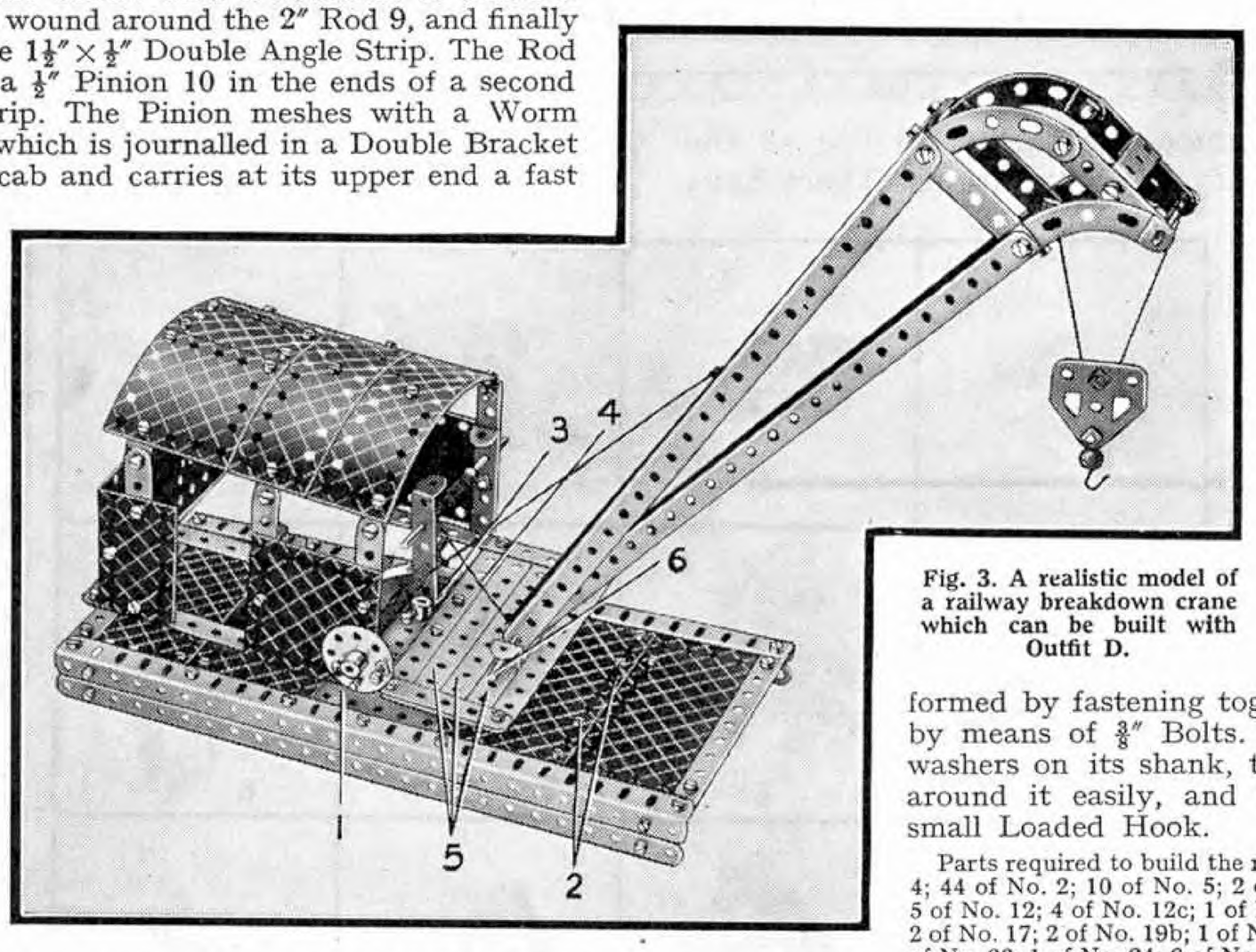


Fig. 3. A realistic model of a railway breakdown crane which can be built with Outfit D.

Parts required to build the traction engine: 8 of No. 2; 3 of No. 3; 7 of No. 5; 2 of No. 6a; 1 of No. 10; 3 of No. 11; 7 of No. 12; 2 of No. 12a; 3 of No. 16; 2 of No. 17; 2 of No. 18a; 2 of No. 19b; 2 of No. 20b; 4 of No. 22; 1 of No. 23; 1 of No. 24; 2 of No. 26; 1 of No. 32; 1 of No. 35; 58 of No. 37; 4 of No. 37a; 15 of No. 38; 1 of No. 44; 2 of No. 48; 2 of No. 53; 4 of No. 59; 3 of No. 111c; 2 of No. 126a; 1 of No. 160; 1 of No. 162a; 1 of No. 162b; 1 of No. 163; 1 of No. 164; 1 of No. 176; 2 of No. 186; 2 of No. 188; 2 of No. 191; 2 of No. 192.

The railway breakdown crane illustrated in Fig. 3 is constructed with Outfit D. It represents a machine of the type used for clearing the track after a railway accident and for lifting derailed locomotives or coaches back on to the metals.

The framework of the truck consists of two 12½″ Angle Girders, joined at each end by a 5½″ Strip, and is filled in with 4½″ × 2½″ and 5½″ × 2½″ Flexible Plates and a 5½″ × 2½″ Flanged Plate 1. The sides of the Angle Girders are extended downwards by 12½″ Strips secured in position by Flat Brackets. Underneath the truck at the front is a Double Bent Strip, to which a Flanged Sector Plate is pivotally attached, by a lock-nutted Bolt. Two 3½″ Rods are pushed through the holes at the ends of the flanges, and two 1″ Pulleys are secured at their ends to form a bogie. In order to limit the movement of the bogie a Driving Band is fastened through one of the holes at the rear of the Flanged Sector Plate, and then is slipped over a Threaded Pin attached to the front flange of the Flanged Plate 1.

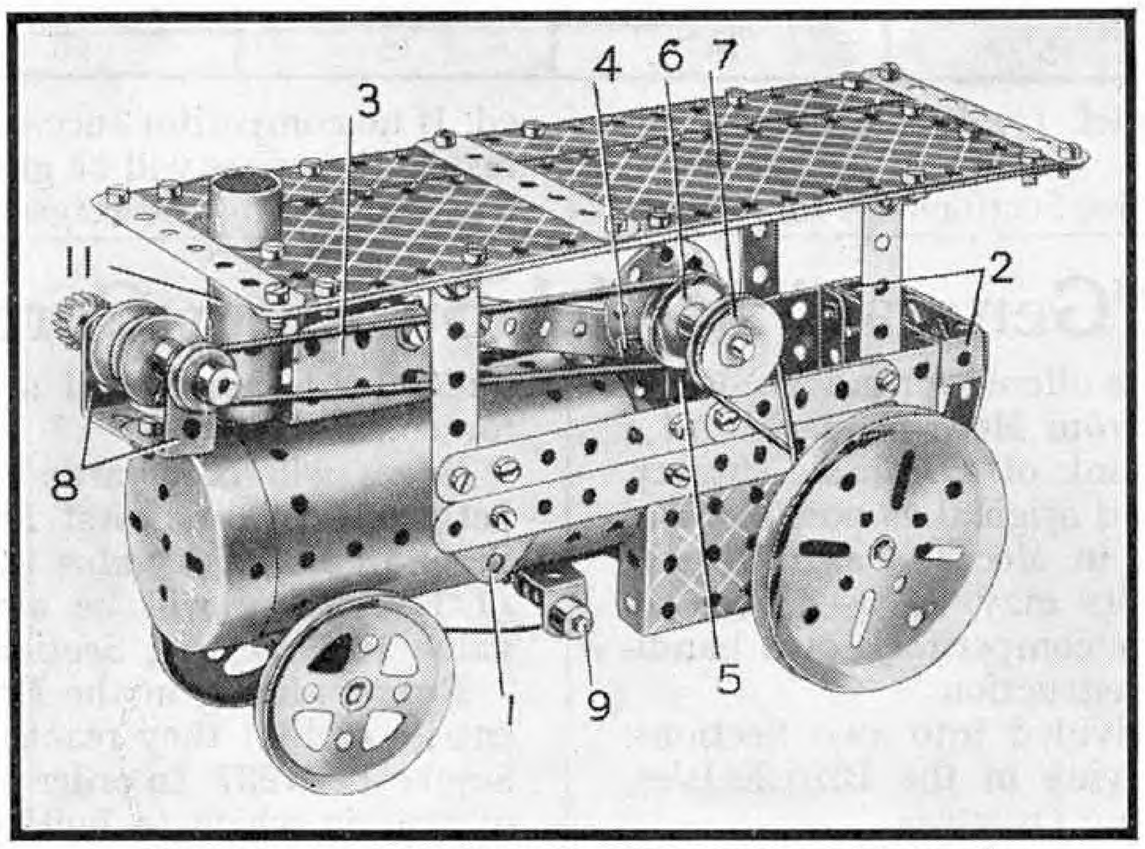


Fig. 4. A neat model traction engine of the type seen at fair grounds.

Two Trunnions are fixed underneath the truck by means of Bolts 2, to provide bearings for a 3½″ Rod that forms the rear axle. A 1″ loose Pulley is slipped on each end of the Rod and is held in position by a Spring Clip. The Trunnions are spaced from the Flexible Plate by washers, so that the rear wheels are at the same level as the front wheels.

The framework on which the cab is built is formed by joining the ends of two compound strips by a 5½″ Strip. Each of the compound strips consists of two 5½″ Strips overlapping five holes. The 3″ Pulley 3 is secured to the framework by the 5½″ Strip 4, and carries on its underside a 2½″ × ½″ Double Angle Strip that rests on a second 3″ Pulley, which is fixed to the truck and holds a 2″ Rod in its boss. The upper end of the Rod passes through the boss of the 3″ Pulley 3, but is not fastened in it.

The sides of the cab are secured to the frame by means of 2½″ × ½″ Double Angle Strips, and the Flexible Plates forming the roof are also supported from these by 2½″ Strips and Obtuse Angle Brackets. The 5½″ Strips 5 are held between the frame and two 2½″ Strips.

The main part of the jib is made from 12½″ Angle Girders, secured at the bottom by the Rod 6 and spaced at the top by 2½″ × ½″ Double Angle Strips and 1½″ Strips. The 3½″ Rod 6 is supported in the centre holes of two Reversed Angle Brackets bolted to one of the Strips 5, and the overhanging structure of the jib is made with small radius Curved Strips and 2½″ Strips.

The pulley block is formed by fastening together two Flat Trunnions by means of ⅜″ Bolts. The upper Bolt has four washers on its shank, to allow the Cord to slide around it easily, and the lower Bolt carries a small Loaded Hook.

Parts required to build the railway breakdown crane: 4 of No. 4; 44 of No. 2; 10 of No. 5; 2 of No. 6a; 4 of No. 8; 8 of No. 10; 5 of No. 12; 4 of No. 12c; 1 of No. 15a; 1 of No. 15b; 3 of No. 16; 2 of No. 17; 2 of No. 19b; 1 of No. 19s; 4 of No. 22; 2 of No. 22a; 1 of No. 23; 1 of No. 24; 6 of No. 35; 85 of No. 37; 6 of No. 37a; 12 of No. 38; 1 of No. 45; 1 of No. 48; 7 of No. 48a; 1 of No. 51; 1 of No. 52; 1 of No. 54a; 1 of No. 57c; 4 of No. 90a; 6 of No. 111c; 1 of No. 115; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 176; 2 of No. 188; 2 of No. 189; 4 of No. 190; 2 of No. 191; 2 of No. 192; 2 of No. 199; 2 of No. 200.

The remaining model to be described this month is a simple representation of an electric truck of the type used at most railway stations for conveying light goods from one platform to another. The model is intended for those boys who have only a small stock of parts (Outfit A is sufficient), but who possess also a No. 1 Clockwork Motor.

Construction is commenced by bolting the Clockwork Motor in a vertical position at right angles to one end of a 5½″ × 2½″ Flanged Plate that forms the platform of the truck. The two axles, which are 3½″ Rods, are each carried in a 2½″ × ½″ Double Angle Strip, bolted underneath each end of the Flanged Plate. Each axle is fitted with two 1″ Pulleys, which form the road wheels. The weight of the Motor tends to tip the truck on end, and to counterbalance this, a weight is fastened at the rear of the 5½″ × 2½″ Flanged Plate. The weight is formed by five 2½″ Strips, secured to the rear flange of the Plate by two ⅜″ Bolts, and also by four small radius Curved Strips, which are fastened underneath the Flanged Plate.

The driving shaft of the Motor is removed and a 2″ Rod inserted in its place. A ½″ loose Pulley is clamped between two Spring Clips on the end of this Rod, and is connected by a Driving Band to one of the 1″ Pulleys on the front axle. It is important to ensure that the Driving Band is led to the ½″ Pulley in a direct line with the groove, in order to avoid unnecessary friction.

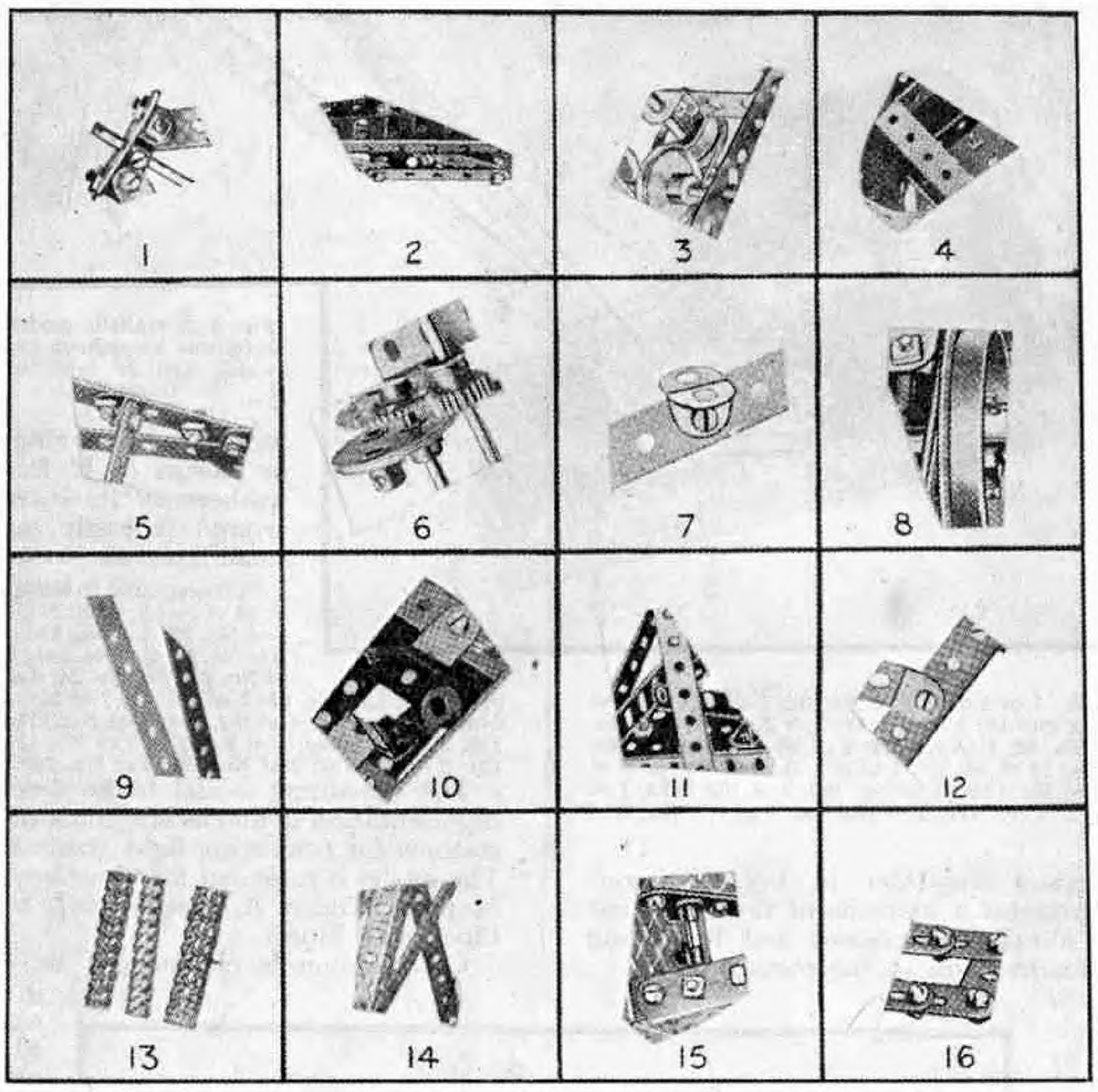
The driver's platform consists of a Trunnion, which is bolted to the lower end of the sideplate of the Motor, and a dummy control handle is represented by a Bolt fixed to a Flat Bracket. The Flat Bracket is carried on a 2″ Rod passed through two Angle Brackets bolted to the Motor.

Parts required to build the electric truck: 9 of No. 5; 1 of No. 10; 3 of No. 12; 2 of No. 16; 2 of No. 17; 4 of No. 22; 1 of No. 23; 4 of No. 35; 11 of No. 37; 5 of No. 37a; 2 of No. 48a; 1 of No. 52; 4 of No. 90a; 4 of No. 111c; 1 of No. 126; 1 No. 1 Clockwork Motor (not included in Outfit).

Meccano Competitions Open to All Readers

Third "Lynx Eye" Contest

This month we announce the third and last of the special summer "Lynx Eye" Competitions. There have been very large entries in the two previous contests, details of which were given in the June and July issues of the *"M.M."* These proved popular, and we have no doubt that the present Contest will be equally attractive to readers.



As in the previous "Lynx Eye" Contests each of the 16 pictures illustrated on this page is a fragment taken from an illustration of a model in the Meccano O/E and F/L Instruction Manuals, and all a competitor has to do is to find out from which Manual illustration each fragment has been taken. Entries should be on postcards, and for each picture the competitor should give first the number attached to it on this page, and then the number of the Manual model from the illustration of which it is taken.

The Contest is divided into two Sections—A for readers living in the British Isles; B for readers living Overseas. Entries must have on them the competitor's name and full address and must be addressed "Third Lynx-Eye Contest," Meccano Ltd., Binns Road, Liverpool 13. Those in Section A must reach Liverpool not later than 30th September 1937. The Overseas Section will remain open for entries until 30th October 1937.

The following prizes will be awarded in each Section to the competitors who succeed in solving the greatest number of the puzzle pictures: First, Meccano or Hornby Train products value £2/2/–; Second, products value £1/1/–; Third, products value 10/6.

If more than one competitor solves all the puzzles, the prizes will be awarded to the first correct entries examined. If no competitor succeeds in submitting an all-correct result, the prizes will be given in order of merit to the entries containing the largest number of correct solutions.

August "General" Model-Building Competition

In this competition prizes are offered for models of any kind whatever built entirely from Meccano parts. All a competitor has to do is to think of a suitable subject, choosing one that is as new and original as possible, and then set to work to build it in Meccano as neatly as possible. Any number of parts may be used, but all models submitted must be the competitor's own handiwork, both in design and construction.

The competition will be divided into two Sections: (A) for readers of all ages living in the British Isles; (B) for readers of all ages living Overseas.

When the model is completed a photograph or a good drawing of it should be sent to "August General Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13. More than one model may be submitted, but no competitor may win more than one prize. If two or more models are submitted by one competitor they will be considered jointly. The competitor's age, name and address must be written on the back of each photograph or drawing submitted, together with the name of the competition and letter A or B indicating the Section for which the entry is eligible. It should be clearly understood that actual models must not be submitted for consideration.

Prizes will be awarded in each Section of the competition as follows: First, Meccano products value £3/3/–; Second, products value £2/2/–; Third, products value £1/1/–. There will be also further prizes of products value 10/6 in each Section.

Readers living in the British Isles must forward their entries so that they reach Liverpool not later than 30th September 1937. In order to give Overseas readers plenty of time in which to build their models the closing date for Section B is extended to 30th November 1937.

All prize-winners will be notified by post as soon after the closing dates as possible, and they will have the opportunity of choosing any items they like from current price lists. Models that already appear in any of the Meccano publications are not eligible for entry in this contest.

Photographs or drawings of prize-winning models become the property of Meccano Ltd., but unsuccessful entries will be returned if a stamped addressed envelope is enclosed for that purpose.

Model-Building Competition Results

By "Spanner"

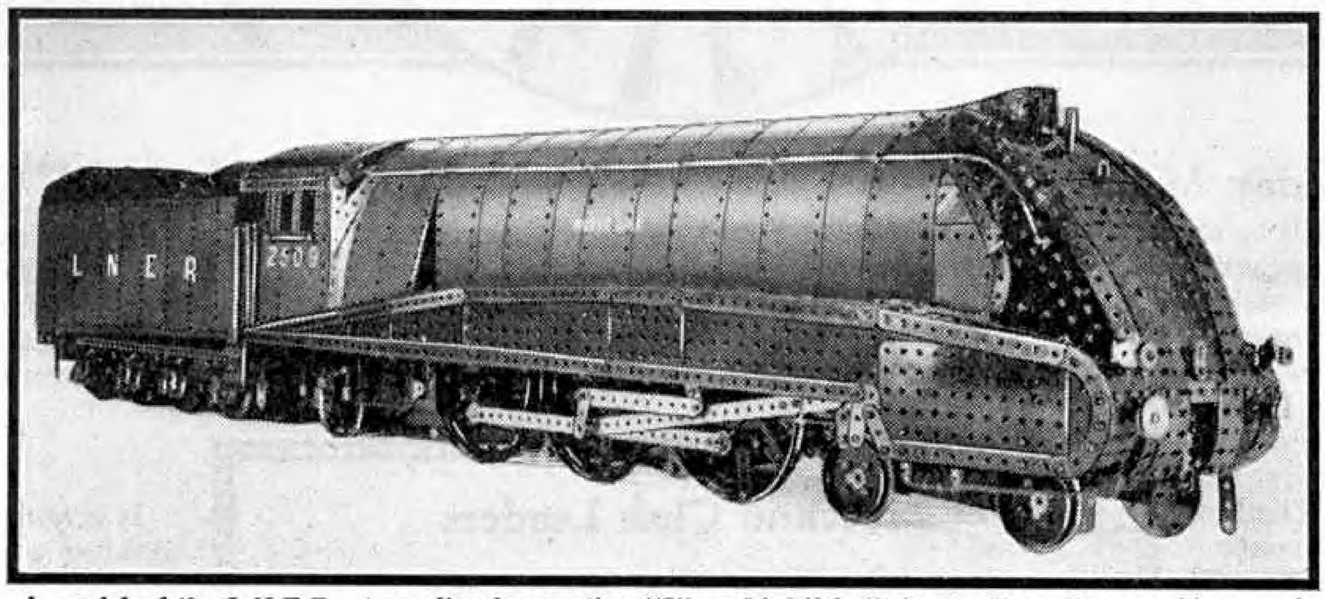
"New Year" Contest (Overseas Section)

The full list of awards in the Overseas Section of the "New Year" Model-building Competition is as follows:

1st Prize, Meccano or Hornby products value £3/3/–: Anibal C. Pereira, Lisbon. 2nd, products value £2/2/–: Pablo Giese. Buenos Aires. 3rd, products value £1/1/–: H. van Nispen, Laren, Holland.

Products value 10/6: G. v. Delft, Tilburg, Holland; S. Bossi, Torino, Italy; A. V. Butcher, Christchurch, New Zealand; P. Swan, Rangoon; N. Diehl, Buenos Aires; F. Schorrewegen, Lierre, Belgium.

Products value 5/–: S. Chappell, Germiston, Transvaal; R. Latimer, Tamwe, Rangoon; A. Norgrove, Blenheim, New Zealand; D. Saunder, Salisbury, S. Rhodesia; R. Myburgh, Claremont, S. Africa; N. Kalligeris, Athens.



A model of the L.N.E.R. streamline locomotive "Silver Link" built by P. Giese, Buenos Aires, and awarded Second Prize in the Overseas Section of the "New Year" Competition.

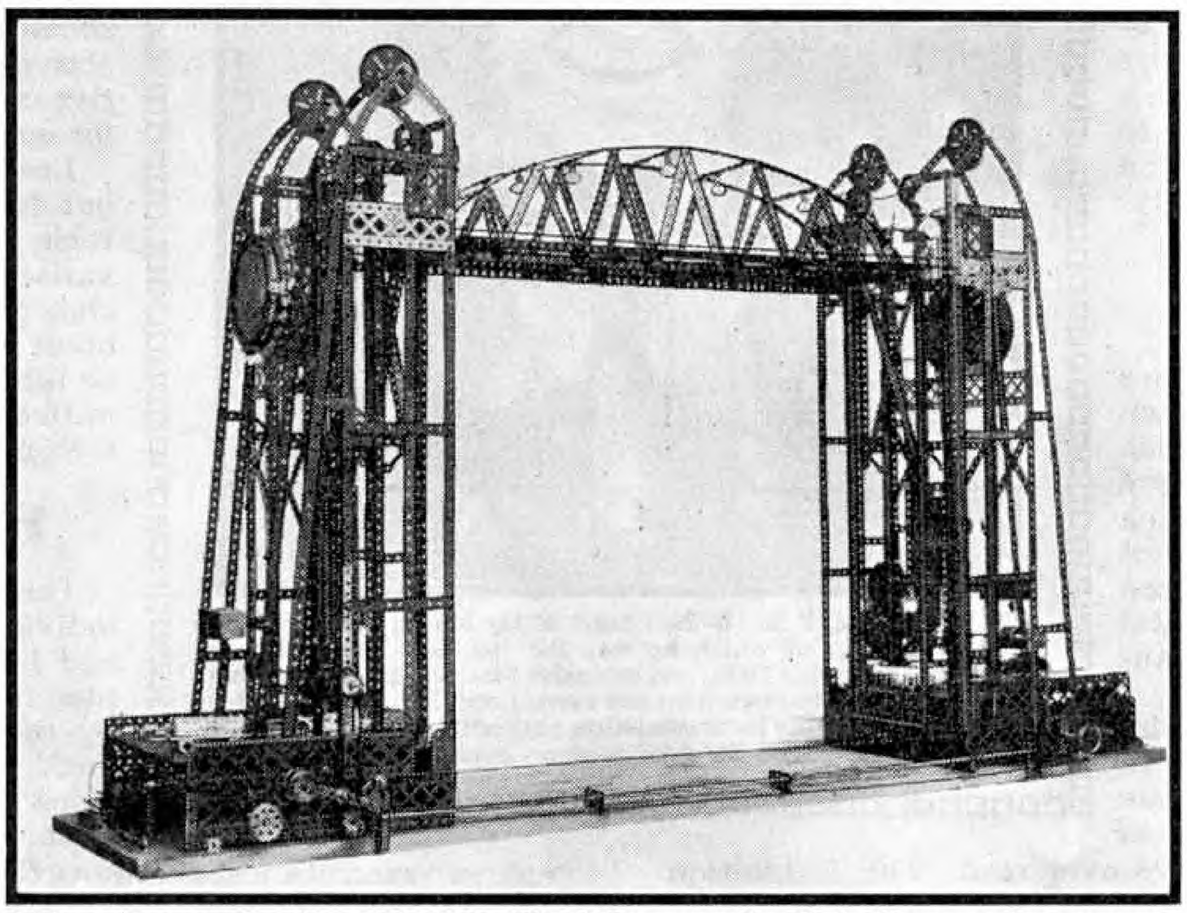
A detailed model of a Portuguese man of war, built by A. C. Pereira, was considered the finest entry in this Contest, and was awarded First Prize. The splendid appearance of this model is due largely to the great amount of detail work, including three swivelling gun turrets, two of which are at the stern, while the third is immediately in front of the bridge. Each turret consists of a Flanged Sector Plate, fastened to a Boiler End by Flat Brackets, and pivotally attached to the deck by means of a Rod. Rods are used also to represent the gun barrels.

The funnels are formed by Boilers, which are fixed at a rakish angle on a raised central portion of the deck, and the exhaust steam pipes are represented by Rods attached to the funnels by Handrail Supports. Two masts, each constructed from 12½" Angle Girders, are placed fore and aft of the raised portion on which the funnels are mounted. The forward mast carries at its head a control station for the guns, and also provides support for the bridge.

A short deck for aeroplanes is provided at the stern of the vessel and is fitted with a small derrick crane for lowering the machines on to the water. To add realism Pereira has made use of a Dinky Toys "Singapore" Flying Boat, and several miniature figures placed in appropriate situations give a final touch to the model.

A popular subject with model-builders at the present time is the L.N.E.R. locomotive "*Silver Link*," and several fine models of this famous streamline engine have been entered in recent Contests. One of the best of these is that submitted by P. Giese in the present Contest, in which it was awarded Second Prize, and illustrated on this page. The model is nearly 6 ft. in length, and it is evident that great care was taken in its construction. Flexible Plates are used for the boiler and are secured to a framework consisting of Circular Girders and Strips. The driving wheels are actuated by a 6-volt Electric Motor, which is mounted inside the Boiler and is controlled by a lever from the cabin. Another lever in the cab controls the application and withdrawal of the brake shoes fitted to the driving wheels.

A fine model of the Barendrecht Lifting Bridge, which spans the Oude-Meuse waterway near Barendrecht, Holland, secured Third Prize for H. van Nispen. Illustrations of the actual bridge appeared on pages 950 and 951 of the "*M.M.*" for December 1934, and a photograph of van Nispen's entry is reproduced on this page. In the model the centre span is raised and lowered by means of an E20 Electric Motor and is capable of a vertical movement of 2 ft. The roadway has three divisions, for traffic, bicycles and pedestrians respectively. When the bridge is raised to permit vessels to pass along the waterway, barrier gates at each end rise automatically across the approach roads, and a red light bearing the word "Stop" flashes in each of the towers. As the bridge is lowered the gates sink into slots, and a green light signals "All Clear." A second Electric Motor is used for raising and lowering the gates, and also operates the mechanism of two flashing electric advertisement signs attached to the towers. The approach roadways and the bridge are lighted by electric bulbs.



This well-proportioned model of the lift bridge over the Oude-Meuse waterway, near Barendrecht, Holland, is the work of H. van Nispen, Laren, Holland, and won Third Prize in the Overseas "New Year" Competition. It is fitted with automatic electric signal lights.

A. V. Butcher entered a novel and interesting model of a "cyclogiro." This has two cabins, one above the other, and two paddle-like propellers, which are placed on the sides of the upper cabin and are driven by an E6 Electric Motor mounted inside the lower cabin. In the model each cabin is fitted with seats and illuminated by means of electric bulbs, and the motor switch and the controls for operating the rudder and elevators are fitted in front of the pilot's seat.

A prize was awarded to F. Schorrewegen for an electrically-operated dish rocker for use in developing and fixing photographic plates and paper. The developing dish is fixed by Spring Buffers to a 5½" × 2½" Flanged Plate, which rests on a 1" Sprocket Wheel. The Wheel is fastened to a Rod that is slowly rotated by an Electric Motor, and as it rotates the teeth jerk the dish gently and keep the liquid in motion.

"Aeroplane" Model-Building Contest

Home Section

1st Prize, Meccano or Hornby products value £3/3/–: L. Sanders, Muswell Hill, London, N.10; 2nd, products value £2/2/–: J. McArthur, Southampton; 3rd, products value £1/1/–: Miss L. J. Slater, Portsmouth.

Products value 5/–: T. Green, Stockport; E. Dredge, Fordingbridge; R. Wheeler, London, N.W.1; J. Brown, Hastings; P. Lancaster, Camberley.

Overseas Section

1st Prize, Meccano or Hornby products value £3/3/–: F. Trasler, Lachine, P.Q., Canada; 2nd, products value £2/2/–: A. Pannenborg, Den Haag, Holland; 3rd, products value £1/1/–: H. Sandle, Dunedin, New Zealand.

Products value 5/–: S. Griffin, Toronto; C. Turner, Johannesburg; A. Goddard, Pietersburg, S. Africa; J. Rowston, Orange, Australia.

"Most Useful Parts" Voting Contest

1st Prize, Meccano or Hornby products value £2/2/–: T. Boyd, Aberdeen; 2nd, products value £1/1/–: R. Howitt, Newark-on-Trent; 3rd, products value 10/6: E. Boardman, Exeter.

Products value 2/6: J. Smith, Leominster; J. Greasley, Preston; M. Glasgow, Waitara, New Zealand.



The Holiday Month

This month many members will be away on holiday, either at the seaside or in the country, and those who stay at home will endeavour to be out of doors as much as possible. I hope that every member will have a thoroughly good time, wherever he may be.

For those who remain at home, a programme that is devoted more fully than usual to the lighter side of club life should be arranged. The uncertain weather of the English summer makes it necessary for Leaders to keep in mind some indoor alternative to any outdoor event, so that there is something to take the place of a game or ramble that has to be cancelled. Indoor games are an excellent solution to the problem, and other suitable alternatives are the reading of a detective novel, in which each member in turn takes a chapter or a part of one, or a "Suggestions" conference, at which the members put forward for general discussion new and novel ideas for improving the club programme next winter.

Overhauling club stock and rearranging cupboards is another occupation that could occupy spare evenings of this kind. Many boys revel in such tasks, especially if they are allowed to work out schemes for themselves and encouraged to accept responsibility.

Attractive Summer Exhibitions

Many Meccano clubs hold Exhibitions during the summer, or arrange garden fetes and other outdoor events at which displays are made of club work. There is much to be said for this plan, which has the advantage that visitors are not required to venture out of doors when it is cold or dark, and several successful summer Exhibitions have been organised recently.

One of these Exhibitions was held by the Islington M.C. and H.R.C. Branch, and the enterprise of its members was recognised by one of the best press reports of such displays that I have ever read. The Exhibition included a splendid array of Meccano models, mostly of an engineering character, and in the words of the report, "it was obvious that the members had taken every possible step to ensure that their models should be correct in every detail." An outstanding attraction was a scale model coal-fired locomotive capable of drawing 12 persons at a speed of 10 m.p.h. The report concluded with the remark that "the technical skill and knowledge of the members impressed the visitors as to the good work the Guild is doing."

Another Summer Exhibition was that of The Beeches M.C., of De La Salle College, Jersey. This was the initial effort of members, and the display was a source of great interest to the pupils of the College. Its chief features were Meccano models, a railway layout on which an electric train ran throughout the Exhibition, and sections devoted to fretwork and stamp collecting.

The Colchester M.C. also organised an Exhibition that reflected the many interests of its members. The club President, the Rev. O. B. Grosvenor, who has won many prizes in Meccano model-building competitions in the past, exhibited a model penny-in-the-slot machine that showed a series of illuminated pictorial designs when a coin was inserted. This machine was a special attraction, and proved a useful source of revenue.

Meccano Club Leaders

No. 90. Mr. J. S. Beard, B.Sc.



Mr. J. S. Beard, B.Sc., is the Leader of the Mount Senior School (Newark) M.C., of which he was the founder. The club was affiliated in October 1936, and extensive Meccano model-building and Hornby Train operations are carried out. It has been visited several times by the local education authorities, who are pleased with the good progress made.

Planning Ahead

It is not too early for Leaders to begin making plans for the first of the two Winter Sessions, and the comparative lull in club activities that the holiday month brings with it, provides a welcome opportunity for quiet reflection upon the past work of the club. Certain features, in addition to model-building and Hornby Train operations, will at once come to mind as having been exceptionally popular with the membership as a whole, and these may be jotted down as "certainties" for the Winter Session. Other activities that may not have aroused such general enthusiasm, but yet may be considered worth while, should be noted as "probables," and any activities that have not proved attractive should be dropped, at any rate for one winter.

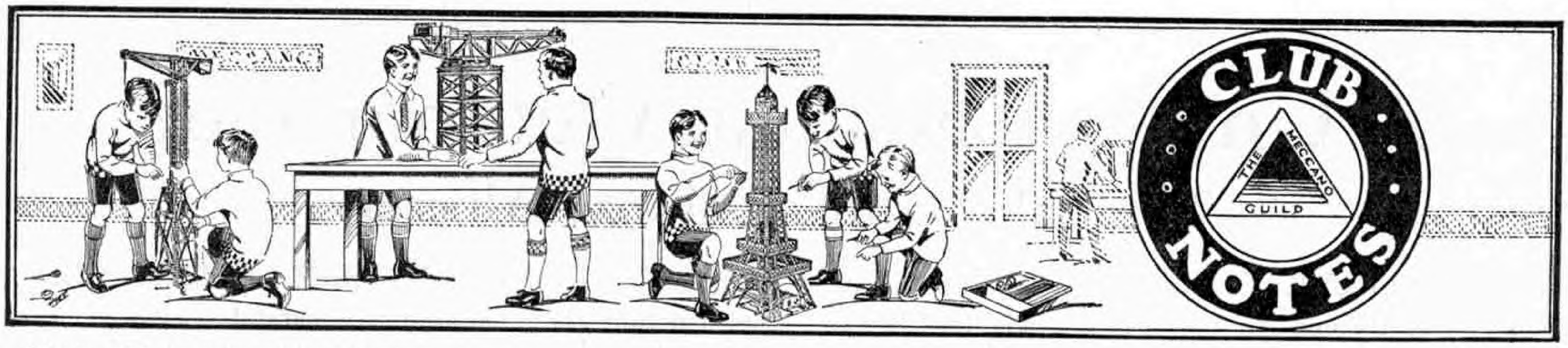
Leaders should always be on the lookout for new lines of activity that by their novelty will provide attractive variations to the regular features of the club programme. Any good ideas that occur should be noted, so that they can be brought forward when the club committee meet next month to decide upon the programme for the Winter Sessions.

Helping the Secretary

The club secretary is a very busy individual, particularly in a large club, and I was interested to hear of a good plan to help him that has been adopted by members of the Malvern M.C., of South Africa. This club is one of the oldest in the Meccano Guild, having been affiliated in 1921, and the reports of the successive secretaries have shown that it has always been distinguished for good-fellowship and the wide range of interests of its members.

The outdoor pursuits of the club include cricket, cross-country runs, rambles and picnics, and among the chief indoor activities are games, concerts, lectures, short talks, parties and dances. It is clearly impossible for the secretary to keep track of all these interests, and therefore certain members write reports on proceedings of purely recreational kind, to which special meetings are devoted. The reports are then read at club meetings, and are always listened to with great interest.

The secretary recently sent me a batch of these reports, and they reveal that the club is rich both in literary talent and in members who take a really keen interest in the programme. Among them was one describing the visit of several members to a garden party in aid of the Epworth Home, for which the club has done much good work.



Islington M.C.—A very successful Exhibition has been held, in which the chief attraction was a model aerodrome. Other outstanding items were working models of ships, a dredger and a farm tractor. Film shows were given at regular intervals. An interesting visit was paid to the Model Railway Exhibition at Westminster. Club roll: 15. *Secretary:* A. D. Straker, 48, Onslow Gardens, Muswell Hill, London, N.10.

St. Stephens (Saltash) M.C.—Rival "Houses" named "*Brunel*" and "*Stephenson*" respectively have been formed, and points are awarded to each in regard to conduct, attendance, and standard of work. Models of the cruisers "*Vindictive*" and "*Frobisher*" have been built to the scale of 1 in. to 100 ft., and a cardboard model of the liner "*Queen Mary*" is under construction. Lectures on "*Submarines*" and "*Composing Photographic Prints*" have been given, and a Debate on the subject "*Road v. Rail*" ended in favour of the road, by a narrow margin. The club staged a Meccano and Hornby display at the Plymouth M.C. Exhibition. The Leader and several members of the Plymouth M.C. have visited the club twice recently, on one occasion bringing the Leader's model 4–6–0 "Royal Scot" locomotive. A visit has been paid to the printing works of the "*Saltash Gazette*." Games are played for an hour at each meeting. Club roll: 14. *Secretary:* B. Braund, 9, Homer Park, Saltash.

Exeter M.C.—The quality of the work turned out continues to be very high, and the variety of the models is as great as ever. The club has been visited by the secretary of the Sid Vale M.C. Cycling runs have been resumed. Club roll: 41. *Secretary:* A. I. Hancock, 237, Monk's Road, Exeter.

St. James' (Grimsby) M.C.—The construction of the club's trolley bus model is well in hand. An excellent curved roof has been made by using Meccano Strip Plates, and miniature seats have been installed. Other features will include sliding doors, guard rails and dummy bell pushes. Club roll: 5. *Secretary:* A. N. Dixon, 65, Yarborough Road, Grimsby.

Wednesbury M.C.—The Meccano Section have been busy stocktaking, and the Woodwork Section have bought additional tools. An adult Leader has been obtained for the Model Railway Section, and it is anticipated that under his guidance it will make good progress. The trestles in the Railway Room have been raised in preparation for relaying the track, which it is hoped will eventually be electrified. A very enjoyable Tea and Social was held to celebrate the 21st birthday of one of the members. Club roll: 25. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

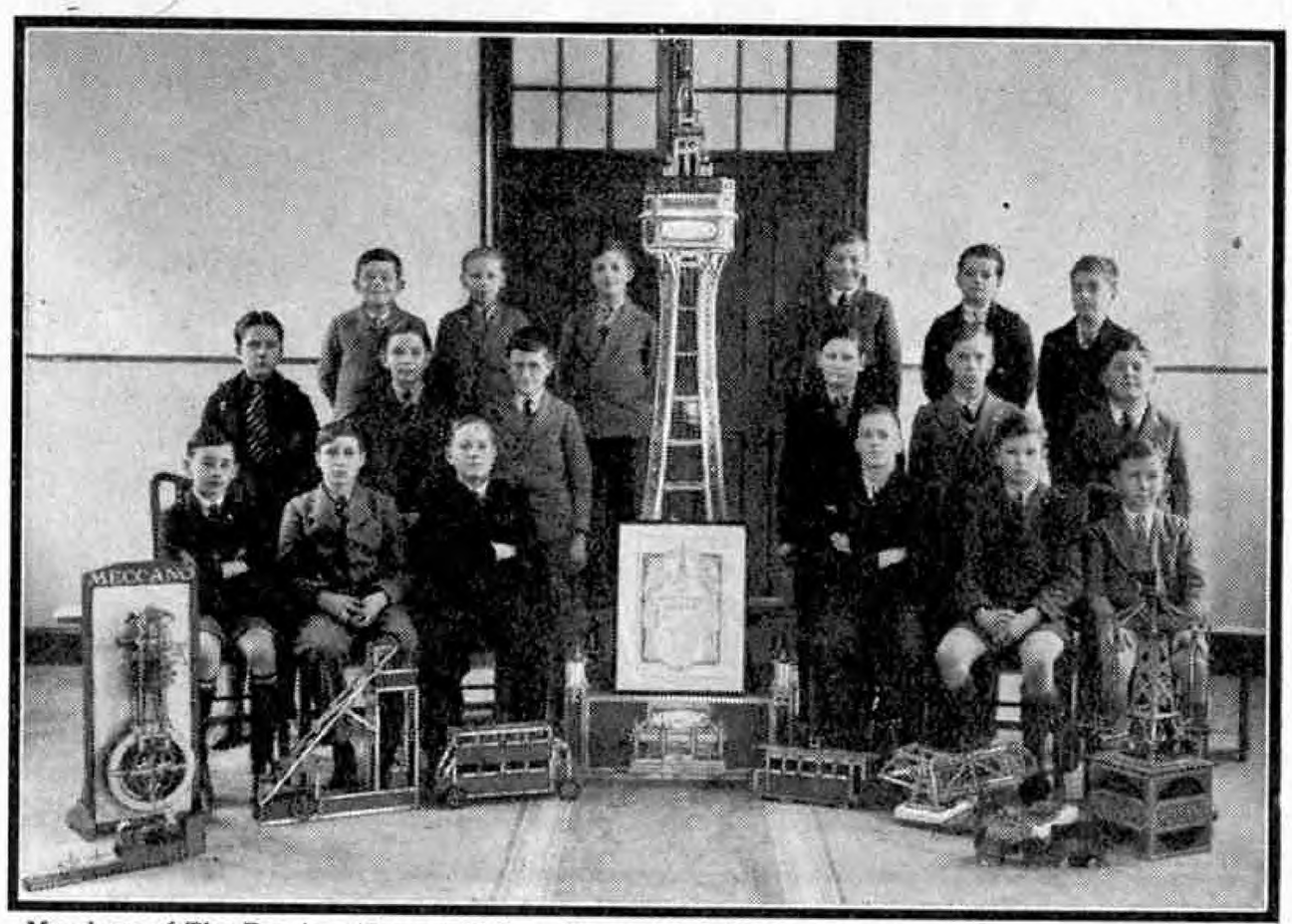
Old Charlton M.C.—An "Odds and Ends Evening" provided a novel variation from the usual programme. On this occasion match-boxes, pieces of string, cotton, and cardboard were distributed and members were called upon to construct models with the meagre material provided. They produced excellent bridges, windmills, a table and other models. Two-minute talks have been introduced and at one meeting devoted to them the most popular subject was the Coronation. A Lecture by Mr. Morphew, an ex-naval officer and father of one of the members, on "*How a Naval Gun is Fired*" was most instructive. The Leader recently gave a very interesting talk on "*Steam and Steam Engines*," with hints on making a model steam engine. The club magazine "*The 'Meccanic'*" continues to be attractive and popular. Club roll: 22. *Secretary:* W. Bailey, 63, Rectory Grove, Woolwich, S.E.10.

Hornsea M.C.—On one Railway Evening Apprentices were allowed to take charge for periods of 10 minutes. On another occasion a film describing and illustrating "*The Manufacture of Cadbury's Chocolate*" was shown. Lectures given to other Sections of the club have dealt with "*The Internal Combustion Engine*"; "*Architecture*"; and "*The Chemistry of Bleaching*." Games are played on the frequent Social Nights. Club roll: 17. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Barnard Castle M.C.—Members recently have been chiefly interested in outdoor pursuits, but on one occasion the Hornby Section turned a wet evening to good account by laying an excellent track and carrying out realistic railway operations. Members are enthusiastic about plans for producing a short play. Club roll: 11. *Secretary:* S. W. Telfer, The School, Barnard Castle, Co. Durham.

Coloured Mission (Cardiff) M.C.—The members of this newly-affiliated club include chiefly West African boys. At the meetings some members carry out model-building while others play games. Excellent models recently completed have included a hammerhead crane, a swing bridge and a tramp steamer. Club roll: 16. *Secretary:* D. H. Binstead, 37, Penhill Road, Llandaff, Cardiff.

Stretford Public Libraries M.C.—At a recent model-building meeting a fine display of Coronation models was arranged. Probably the most outstanding model was one of Westminster Abbey, in which Meccano Girders and Plates formed the roof and walls, and the doors were of cardboard. Two large wheels represented the round windows of the Tower, and Bush Wheels were used for the small window and the clock. The other models included the Coronation Chair, the two thrones and the regalia. Club roll: 31. *Secretary:* Miss F. Scattergood, Public Library Technical Institute, Stretford Road, Old Trafford, Manchester, 16.



Members of The Beeches (Jersey) M.C., with models built by them for their first Exhibition. This club was affiliated in December last year. Its members are pupils of the De La Salle College, Jersey, and are very enthusiastic model-builders. A lantern was bought with the proceeds of the Exhibition. Photograph by courtesy of Albert Smith Ltd., Jersey.

St. Giles' Cathedral M.C.—A three-act play entitled "*The Quest*" was performed recently in the Little Theatre, and was a great success. During Coronation Week an extensive Exhibition was held in the club premises, and included displays by the Meccano, Railway, Aero, Stamp and other Sections of the club. The Stamp Section are now holding monthly displays, and the Meccano Section are also very busy. The summer programme is in full swing, and includes visits to works and other places of interest. Club roll: 347. *Secretary:* A. Nicholson, 132, Trinity Road, Edinburgh.

Todmorden Central School (Burnley) M.C.—Recent activities have included a visit to the printing works of the local newspaper. Two Lantern Lectures have been given, one by the Leader describing "*London's Tube Railways*," and the other on "*London's History and Romance*." Model-building and games have also been continued. Club roll: 24. *Secretary:* L. Hinton, 4, Thirlmere Avenue, Burnley.

Fraserburgh M.C.—Meetings are now held on Friday instead of Saturday, so that cycle runs can be enjoyed on Saturday. The members were included in a school party that recently visited the Fraserburgh gas-works, where the Works Manager explained the various machines, and demonstrated a novel radio detecting apparatus for locating gas-pipes and indicating their depths. Unfavourable weather has restricted the activities of the Aeroplane Section. A Concert may be held to raise club funds. Club roll: 24. *Secretary:* W. J. Dawson, Phingask, Frazerburgh.

Bryntirion M.C.—This club recently held its second Exhibition, and a very fine array of models was displayed. Outstanding items were models of the Quebec Bridge, an automatic crane, weighing machine, and battleship. Club roll: 18. *Secretary:* P. Parry, "Castle Hill House," Carmarthen.

Sutton Valence Council School M.C.—A Sports Contest with the School resulted in a victory for the club. Observation tests for walkers and cyclists during a recent outing proved an interesting innovation. Club roll: 20. *Secretary:* J. Chandler, "Herriard," Chard.

AUSTRALIA

Thebarton Technical School M.C.—The membership has been increasing steadily this year and now includes many boys who are new to club life. Interest in the club programme is therefore exceptionally keen. A visit has been paid to the works of the Western Oxygen Company, where the party were shown the effect of liquid air on various substances and plants. A talk by the President on "*Entomology*" proved very interesting. Club roll: 52. *Secretary:* B. S. Clarke, 21, Victoria Street, Glandore, South Australia.

ITALY

Milan M.C.—The club's sports teams have been re-organised, and the football team has begun intensive training in preparation for a tournament in which they are to take part. The Meccano and Hornby equipment of the club is to be increased. Club roll: 14. *Secretary:* E. Vigo, Corso Genova 19, Milan.

NEW ZEALAND

Christchurch M.C.—Attendance at meetings continues to be very good, and steady recruiting is increasing the membership satisfactorily. Model-building and Hornby operations have been carried out. An interesting talk on "*The Meaning of Anzac*" was given recently by the Rev. A. Read, of the Returned Soldiers' Association. Another visit has been paid to the Ashburton M.C., and shortly afterward the latter visited the Christchurch club-room. Preparations are in hand for the Annual Birthday Meeting. Club roll: 29. *Secretary:* L. P. Chapman, 24, Braddon Street, Christchurch, S.W.1.

SOUTH AFRICA

Malvern M.C.—A senior member's generous offer to award a Meccano Cabinet to the best model-builder during the first half of this year produced great enthusiasm and keen competition. The many excellent models built during recent months have ranged from windmills to ships, boxing rings and racing cars. At one meeting the seniors built models under the critical eyes of the juniors, who had built their models at home. The seniors came through the ordeal well and produced an excellent and varied array of models, mostly of engineering subjects. The 21st birthday of one of the members was celebrated by a club party. Club roll: 68. *Secretary:* C. Courtis, P.O. Box 8, Cleveland, South Africa.

Pioneer (Pietermaritzburg) M.C.—The club took part in an Exhibition at the Pietermaritzburg City Hall, and their display of models was praised by visitors. Future arrangements include a picnic and a debate. Club roll: 11. *Secretary:* A. H. Alley, 461, Burger Street, Pietermaritzburg, South Africa.

EGYPT

Zagazig M.C.—The club has been divided into two Sections, a Junior one for members up to 12 years and a Senior one for older boys. Three meetings are held each week, and all are well attended. Model-building is the chief activity, and each week there is an improvement in the skill of those taking part. The club-room has been equipped with benches suitable for Meccano and wood model-building. Lantern Lectures and visits to places of interest have added variety to the programme. A Cycling Section has been formed. The title of the club magazine has been altered to "*Mechanimage*," and it is now published in Arabic each month. Club roll: 22. *Secretary:* Miss B. Mangourie, 29b, Gannabiet Sikka Hadid Avenue, Zagazig.

A Unique Canadian Outdoor Line

The Lake Edith Railway, Alberta

MOST of the miniature railway systems described in these pages are of the indoor kind, and in planning and laying such a system no particular difficulties are encountered as a rule, apart from those caused by lack of sufficient space. With an outdoor system matters are quite different, for the model railway engineer has to face up to the same difficulties, although on a smaller scale, as are encountered in real practice. Natural obstacles of one kind and another are encountered, and there is always the question of the effects of the weather on the permanent way and works of the miniature system. Special interest therefore is attached to the line described and illustrated in this article, which is known as the Lake Edith Railway. This unique model railway is situated in the Jasper National Park in the Rocky Mountains of Alberta, Canada. It has been planned and constructed practically throughout by Dr. W. Rowan, Professor of Zoology at the University of Alberta. It is operated by Dr. Rowan himself, with the aid of members of his family, who occupy official positions, and take part in discussions on projected new construction of any kind.



A trestle bridge spanning a deep wooded chasm on the Lake Edith Model Railway of Dr. W. Rowan, Alberta. Locomotives of English pattern are used, but the train is made up of Canadian-type baggage, dining and sleeping cars, with an observation car in the rear.

The Lake Edith Railway is about 300 ft. in length and derives its name from the lake along the shores of which it is laid. The track threads its way through firs and spruces on the edge of the water and is surrounded by mountains, some of which are as much as 3,500 ft. in height. The whole system has been designed and laid down with a view to reproducing as far as possible the construction of real railways laid in mountainous country. Therefore it traverses deep rock cuttings and tunnels, climbs steep gradients, and includes many interesting features that are characteristic of railways in Canada.

Many difficulties had to be overcome by Dr. Rowan before the layout was complete. It is simple enough to lay a track over a level foundation indoors, but careful thought is necessary when immovable natural objects are encountered. One of the problems that caused most concern was the laying of the track over massive fir tree roots projecting above the surface of the ground, in some cases at considerable distances from the tree to which they belonged. The offending roots could not be removed or mutilated, and a scheme therefore had to be arranged to prevent them from obstructing the line. After a careful survey it was decided to build bridges of either steel or concrete over them, the level of the track being raised by means of gentle gradients to form a suitable approach. The upper illustration on the opposite page shows one of the schemes adopted by building a truss viaduct over a particularly prominent root.

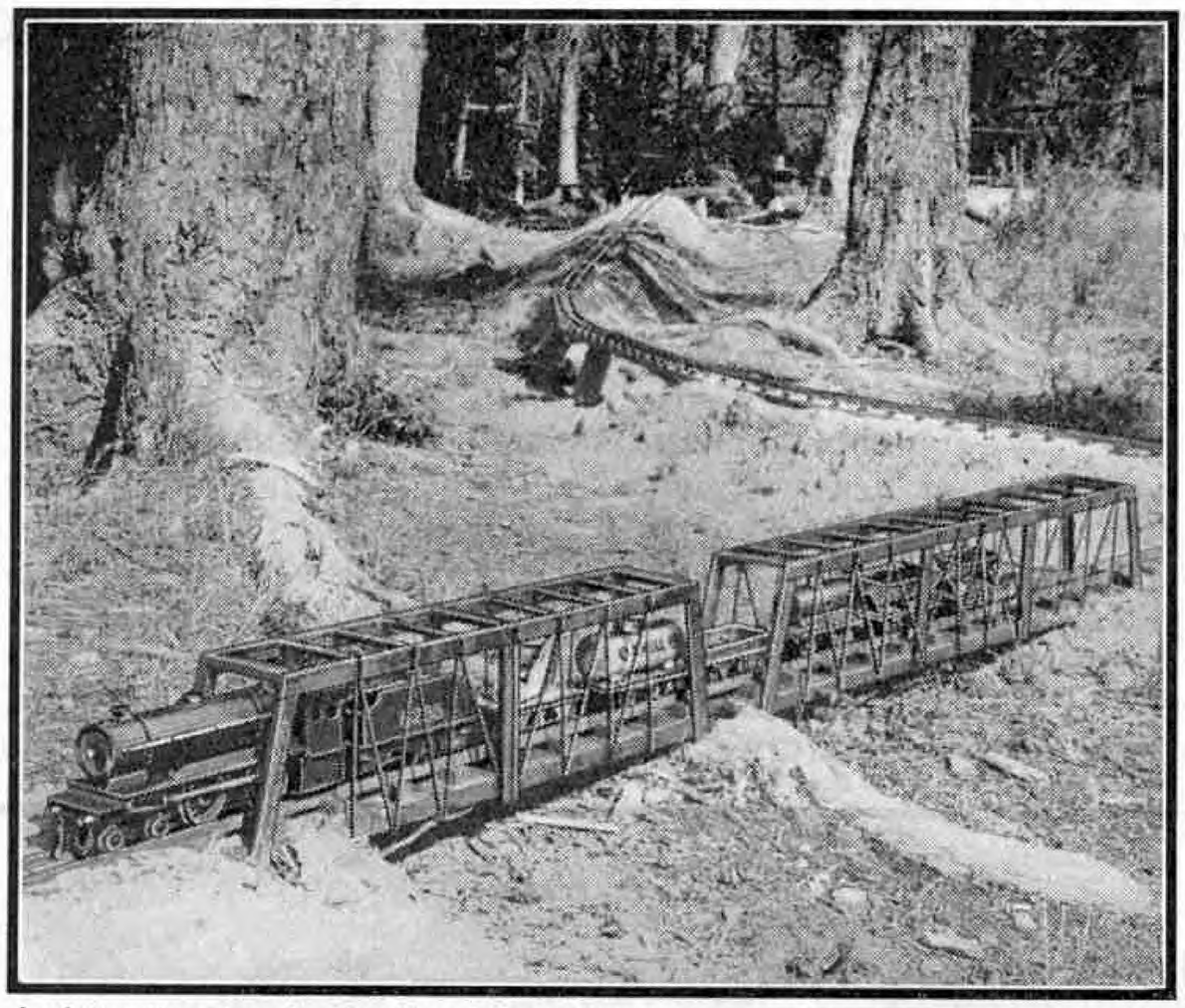
Real railway principles have been applied throughout as closely as possible. For instance, it was followed even in such details as the actual transportation of soil or rock not required in one part of the layout to another section of the track for making an embankment. All the embankments on the Lake Edith Railway are finished off with concrete abutments. Again, it would have been an easy matter to fill in all "ravines" on the route and to run the line over the levelled ground, but it was decided to span any deep depression in the earth with realistic miniature trestle bridges. This type of bridge is not common in this country, but was used extensively in Canada and the U.S.A. as a means of carrying the railway over the precipitous and rocky gorges that caused so many difficulties to the engineers engaged in railway construction in those countries years ago.

The layout is of the continuous variety and generally speaking takes the form of a letter "B." Instead of the centre curved portions of the letter joining one another by double symmetrical type points, however, they cross at an angle and are looped to intersect the long straight portion above and below the centre point. The track is graded in such a manner that the straight section is at the highest point of the layout and the intersections pass under it. The two low-level intersecting lines, after diving under the main line, form a circular loop on the left of the intersections.

The actual running rails consist of iron strips, but although iron is known to rust freely in damp climates, the "engineers" of the Lake Edith Railway consider that the dry conditions of the Alberta climate will prevent any extensive rusting of the track. The slight surface rust that is inevitable, even in the driest of climates, is cleaned off by a gadget that has been specially designed for the purpose. The rails are laid on creosoted wooden sleepers, which are fastened down on wooden baseboards that also are treated with creosote.

The whole track has been carefully ballasted up to the level of the wooden sleepers with fine gravel, giving a most realistic effect.

The railway is not yet completed. The lines for the terminal yard have not been laid, so avoiding loops have been introduced to allow the non-stop through traffic to avoid the tracks through the platforms. The lines for the engine sheds, or roundhouses, as they are called from their invariable form in Canada and the U.S.A., also have yet to be laid and the turntable with other equipment generally found round and about the "home" of the locomotives have not been installed.



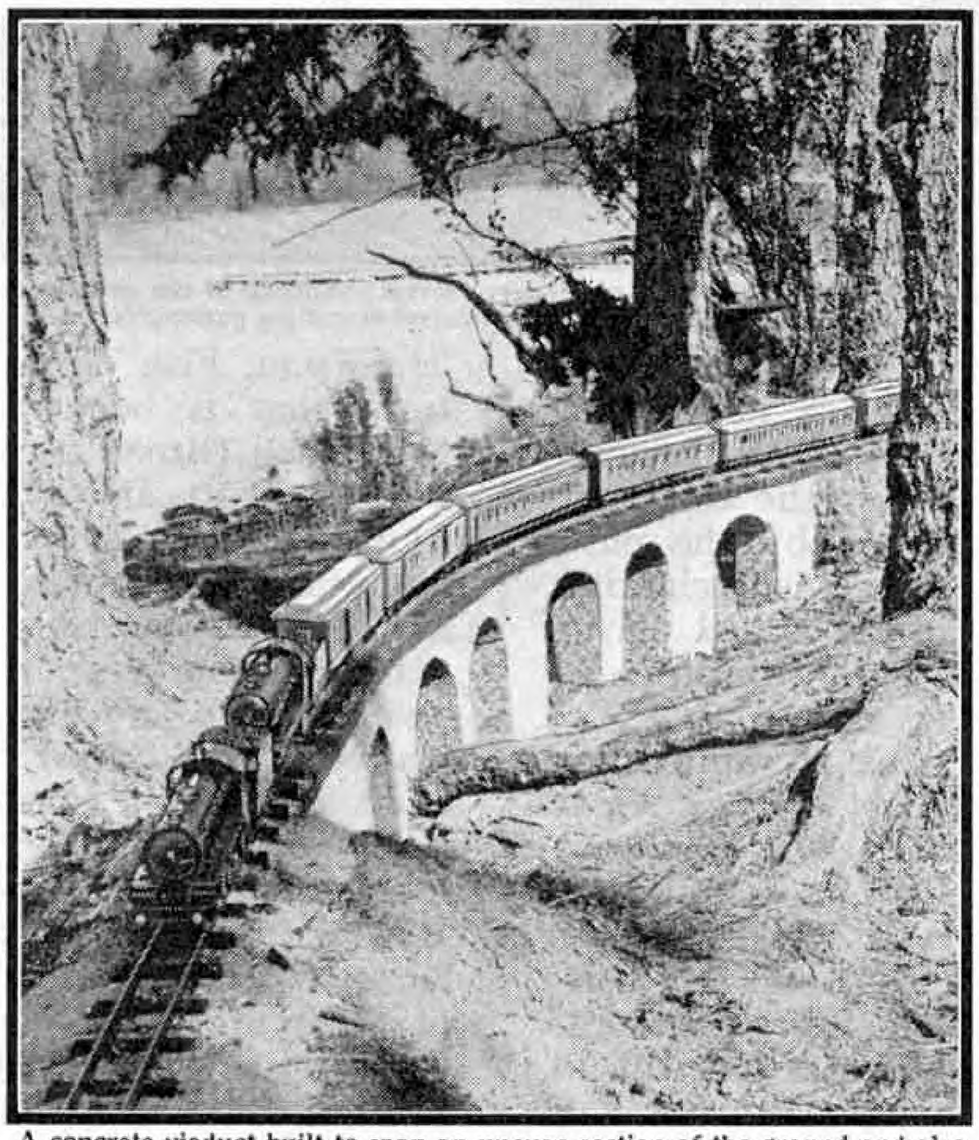
An interesting view showing the miniature line passing through thickly wooded country. This illustration shows how the protruding roots of trees that would cause an obstruction are avoided by means of specially constructed steel truss viaducts.

Both Canadian and British standards have been followed in the equipment of the Lake Edith Model Railway, with pleasing results. The rolling stock, as far as passenger services are concerned, is entirely home-made and consists of scale models of a baggage car, a diner, sleeping and observation cars. All these are similar to the types of vehicles used on the Canadian National Railways system.

Dr. Rowan himself was responsible for the design and construction of these coaches. These realistic vehicles are fitted with glass windows and opening doors, and also have electric illumination, the necessary current for lighting being obtained from a battery that is carried in one of the coaches. The wiring for each coach is connected through the train by means of small plugs and sockets. The complete stock at present consists of seven coaches, each about 20 in. in length.

The vehicles used for freight traffic were not made by Dr. Rowan, and comprise chiefly Hornby rolling stock of English type. The upper illustration on this page shows a freight train of Hornby vehicles made up of a Crane Truck No. 1 Wagon, Petrol Tank and Side Tipping Wagons in charge of a powerful 4–4–0 steam locomotive. A series of typical Canadian box cars is being constructed to run in conjunction with the Hornby vehicles. They are to be scale models in all respects, except that bogies will not be used, the purpose of this deviation from practice being to effect a substantial reduction in weight. They will be four-wheeled cars, and therefore will be considerably lighter than the coaches used for the passenger services. By running four-wheeled stock it will be possible to operate very long goods trains typical of those to be seen on the Canadian railway systems. All rolling stock is decorated with the initial letters of the Lake Edith Railway, L.E.R., and in this respect the Hornby items have been altered also to conform with the home-made vehicles.

English-type locomotives propelled by steam provide the motive power for these trains. The two shown in the photographs to this article are respectively a 4–4–0 and a 2–6–0 or "Mogul." They are generally similar in design and conform to the usual standards of low-pressure boilers with external firing. The 2–6–0 is based on the L.N.E.R. "K3" class, however, and is painted green, while the 4–4–0 is finished in L.M.S.R. red. These two engines together are required to haul the complete passenger train previously referred to over the steep gradients that are prominent features of the Lake Edith Railway. The length of one of the gradients is 15 ft. and on the ascent the exhaust of the two engines becomes more laboured as they toil upward; then in an equally realistic manner they accelerate rapidly when the summit is passed and race down the following gradient.



A concrete viaduct built to span an uneven section of the ground and also to avoid a tree root. The line at this point passes close to the shores of Lake Edith, which can be seen in the background.

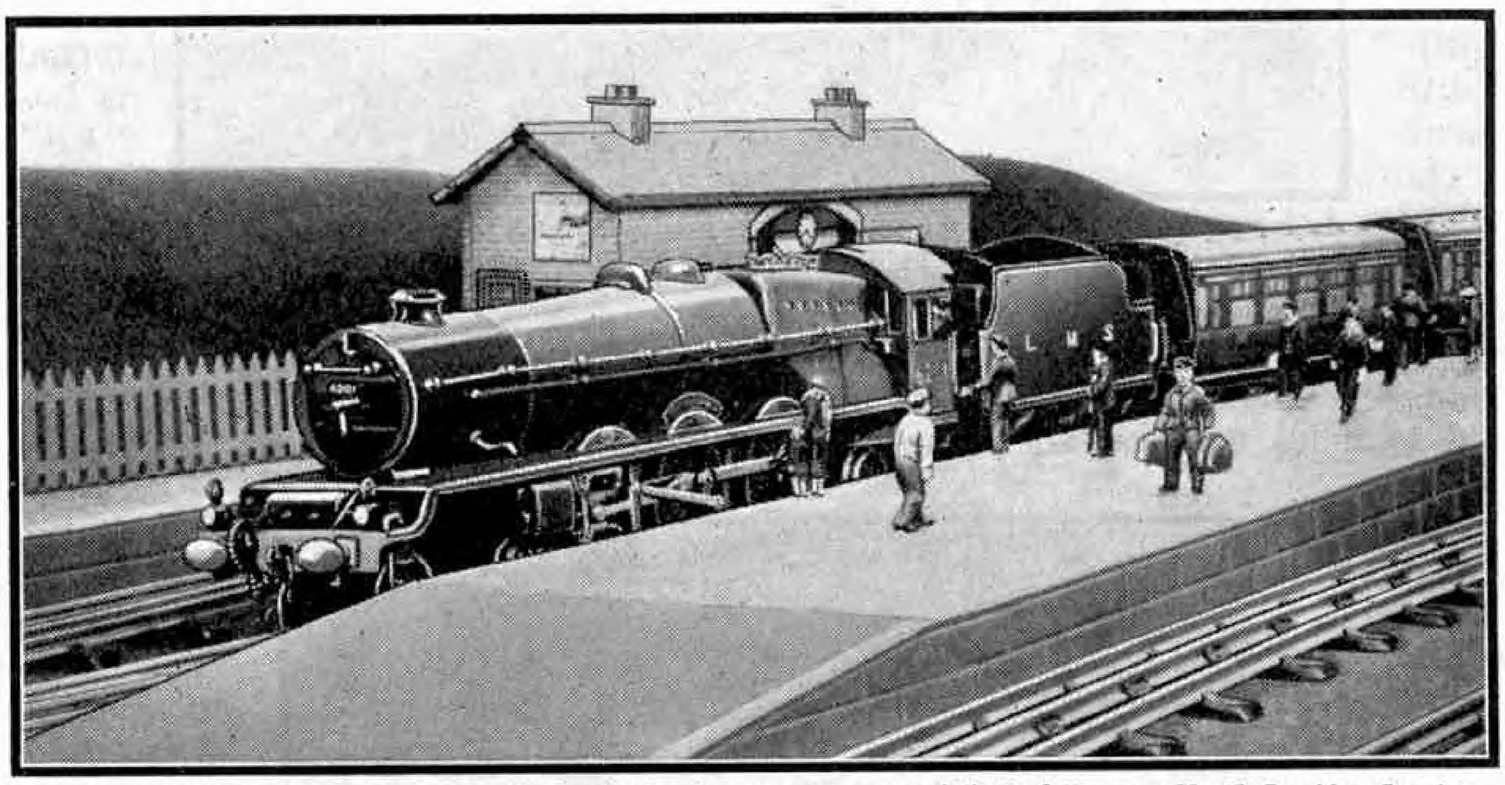
The signalling of the system has not been overlooked, and the line is fitted up with semaphore signals made specially for it by Mr. F. G. Roe who holds the position of "Chief Signalling Engineer" of the L.E.R. Mr. Roe is on the staff of the Canadian National Railways, and therefore is fully qualified for the part he holds on the Lake Edith line. In his younger days, Mr. Roe was particularly well acquainted by the former Midland Railway in this country, and his experience has led to the use on the miniature system of British-type block signalling. Slight variations of course have been necessary, but on the whole the signalling arrangements are as nearly perfect as possible. There are 48 semaphores installed on the layout, and a further 32 will be required to complete the signalling scheme that Mr. Roe has in mind. When the last set has been installed practically every movement will be controlled by signal.

Hornby *"Princess Elizabeth"* in Service

Miniature "Heavy Traffic" Conditions

MORE realistic miniature railway working than ever before has become possible since the introduction of the splendid Hornby scale model locomotive *"Princess Elizabeth,"* which was described in detail in the May *"M.M.,"* and of the new Hornby Corridor Coaches described by "Tommy Dodd" on page 495 of this issue. The running of the new engine, and its management when in traffic, especially at the head of heavy trains made up with the new coaches, is the subject of this article.

The Hornby *"Princess Elizabeth"* is a treasure that will be well cared for by its owners, and will give wonderful service if the directions packed with it are followed. Like a real engine about to take up regular duties, it should be carefully "nursed" before any heavy work is undertaken so that all the bearings become run in and all traces of stiffness are removed. Before it goes out on service it should be examined to see that the wheel treads and collector shoes are clean. The careful "driver" will take special care to see that the armature shaft and axle bearings are properly lubricated, and that the rods and motion of the engine are given a tiny drop of oil at each joint so as to ensure perfectly free running. The Meccano "K" type Oil Can is just the thing for jobs like this, as the flow is controlled by the push button exactly as with a full-size oil can. It is fascinating to go round the engine in this way, as a real driver does with his full scale locomotive, before it proceeds to the station or siding to pick up its train.



The Hornby "Princess Elizabeth" at the head of a heavy express consisting of the new No. 2 Corridor Coaches. The engine is arousing the keen interest of waiting passengers!

"Princess Elizabeth" is exactly what is wanted for hauling miniatures of *"The Royal Scot," "The Night Scot"* or *"The Mid-day Scot."* It is itself a miniature of the real engines used on these famous expresses, and its efficient six-coupled motor has a remarkable capacity both for hauling heavy loads and for continuous high-speed running. Long non-stop runs therefore present no difficulties, and the greatest fun will be obtained if a layout is planned to represent the line from Euston to Glasgow, and heavy expresses are run over it with few calls, and with perhaps a stop to change crews, as in the case of *"The Royal Scot."* A long non-continuous line of course is best for this working. Sufficient space is not always available for this, but the thrill of long sustained running at high speed can be obtained with a layout on which terminal stations representing "Glasgow" and "Euston" are placed on extensions of the main line, which consists of an oval or circular track.

There are many other trains that can be worked realistically in miniature by means of the Hornby *"Princess Elizabeth."* For instance, the new locomotive can be used for the "10.40 a.m. Liverpool" from Euston and for the lighter but faster up 5.25 p.m. *"Liverpool Flyer,"* which completes the journey to Euston in 3 hr. 20 min. The haulage of the 10.10 a.m. *"Merseyside Express"* from Lime Street, Liverpool, to Euston also is a "Princess" turn.

For all these trains the new Hornby Corridor Coaches are ideal. They are fitted with free-running bogies and supplied with corridor connections. The latest destination-board practice of the L.M.S. has been faithfully reproduced on them above the windows, and the trains can be appropriately named to add to their general attractiveness.

Another interesting turn for a "Princess" is not a mile-a-minute uxury express, but a much less imposing fish train! This is the "1.55 p.m. Fish" from Aberdeen, an important freight train that is booked at high speed from Aberdeen to London (Broad Street) in order to catch the market at Billingsgate, and is hauled sometimes by a "Princess." Thus there is plenty of excuse, so often necessary in miniature, for running a goods train with even such a splendid locomotive as the Hornby *"Princess Elizabeth."*

In miniature it is not always possible to have more than one engine of any particular type in service, so that in many cases *"Princess Elizabeth"* will be the only engine of its kind on the line. It will appear therefore on practically every heavy express train of importance. Such intensive use of the locomotive is a parallel of present-day L.M.S. operating practice, for the capacity of modern locomotives is such that the greatest possible use is made of them in traffic, and long mileages are run in the course of a very short time.

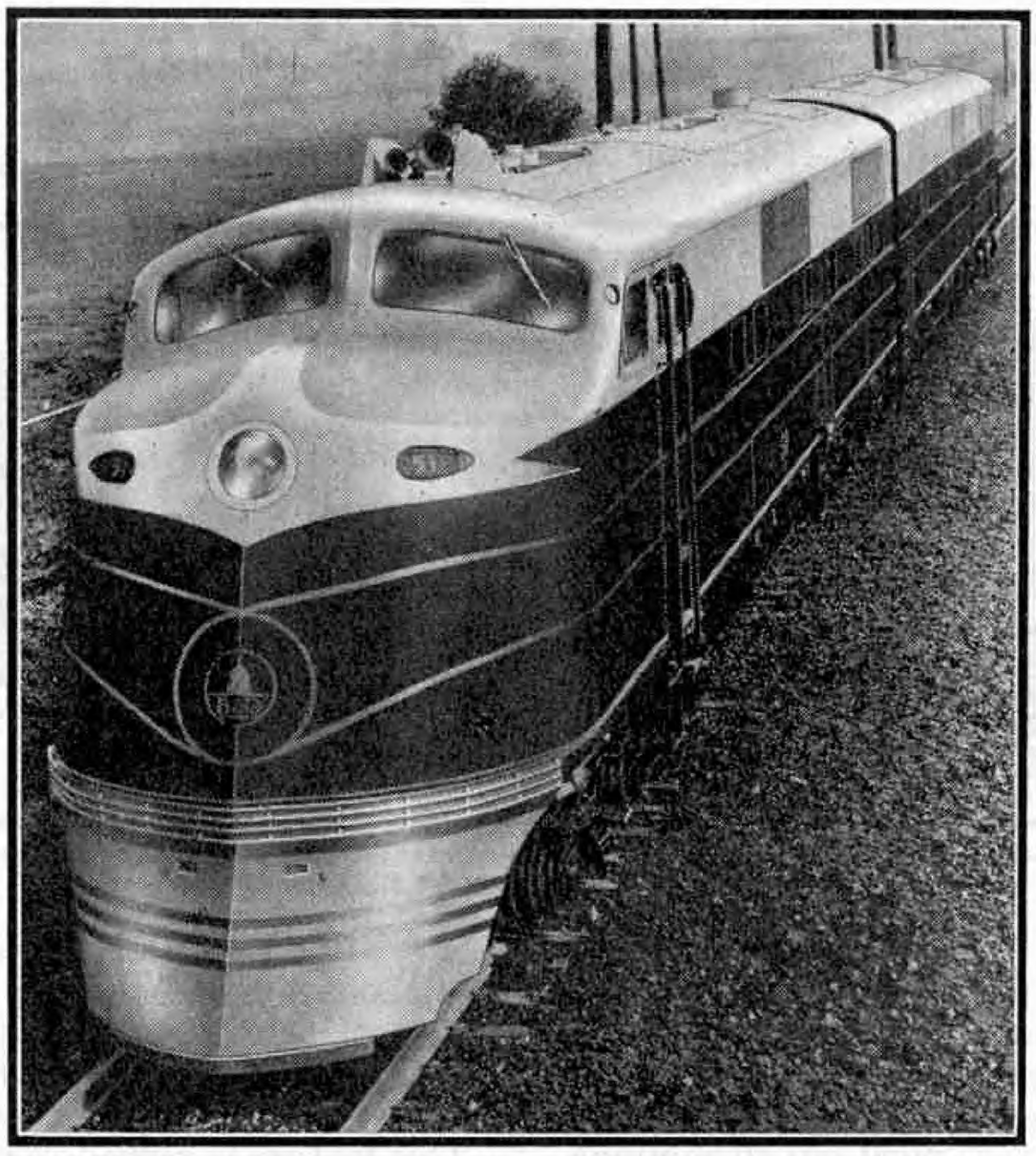
A turn involving what is perhaps the largest mileage covered in 24 hours is regularly undertaken by the L.M.S. 4–6–2 "Princesses." This is the haulage of the down *"Royal Scot"* from Euston to Glasgow, a distance of 401.4 miles, on one day, the return being made the same night with the up *"Night Scot."* Thus one engine runs over 800 miles in approximately 21 hours. The Hornby *"Princess Elizabeth"* is ideal for such workings because its motor is designed for long continuous running.

New American Diesel-Electric Locomotive

Baltimore and Ohio Streamline Design

A DIESEL-ELECTRIC locomotive that is the most powerful of its type to be operated in the east of the United States has recently been introduced on the Baltimore and Ohio Railroad. Remarkable progress has been made in the United States during recent years in the development of locomotives of this type. The fastest train in the world, the *"Super Chief"* of the Atchison, Topeka and Santa Fé Railroad is hauled by a twin unit Diesel-engined locomotive, and the appearance of the Baltimore and Ohio engine marked the completion of regularly-scheduled Diesel-electric operation between the Atlantic and Pacific coasts.

The new locomotive is shown in the accompanying illustration and is the first of several ordered by the Baltimore and Ohio line. Its first run in service was made on a heavy Pullman train bringing passengers from western and south western districts to Jersey City. Until the delivery of the remaining engines of the class it was used to haul the famous streamline *"Royal Blue"* express between New York and Washington, and on the completion of its first run on this service it was met as the train approached Washington by the first American-built locomotive *"Tom Thumb,"* which was constructed for the Baltimore and Ohio Railroad in 1829. The oldest and the newest of American locomotives then moved side by side into the Union Station, Washington, showing in a striking manner the progress of over 100 years of railroad development.



One of the giant 3,600 h.p. Diesel-electric locomotives of the Baltimore and Ohio Railroad. They will be used for hauling the "Capitol Limited" between Washington and Chicago. Photograph by courtesy of the Baltimore and Ohio Railroad.

The new locomotive is of the twin unit type, each unit being provided with two 900 h.p. Diesel power plants so that the total output of the whole locomotive is 3,600 h.p. The twin units are coupled for operation from the driving compartment of the leading vehicle. Each runs on two six-wheeled bogies in which special means have been employed to ensure smooth riding and stability in rounding curves. The outer axles of each bogie truck have an electric traction motor geared directly to them, the centre axles being idlers and necessary for weight carrying purposes only.

Each of the 900 h.p. plants consists of a Diesel engine with the necessary arrangements for its fuel supply, cooling and lubrication. A power generator and exciter, a generator for charging batteries and the necessary electrical controlling gear are included. In addition each locomotive unit carries a fuel tank of 1,200 gallons capacity, and a 1,100-gallon water tank for supplying the steam boiler that is carried for train heating purposes. Each main generator supplies direct current at 600 volts to the 450 h.p. traction motors mentioned previously. These generators also are used for engine starting purposes, and then they receive energy from the battery through separate contactors provided for this purpose. The cooling of each engine is effected by means of water-cooled radiators suspended from the roof. The air for radiator cooling is taken through grilled openings in the sides of the vehicle and is forced out through the radiator assemblies by fans.

As the illustration shows, the driving cab is situated slightly behind the nose of the locomotive, which has been shaped to reduce wind resistance at high speeds and to provide the widest possible outlook for the driver. Safety glass is used for all the cab windows, and those in front have special windshield wipers and a hot air defrosting arrangement in order to secure the maximum visibility for the crew in all conditions. Comfortable seats are provided for the men, the driver being accompanied by a helper, or "fireman," as he would be on a steam locomotive.

The main locomotive throttle is situated in the cab of the first unit, although the second one is equipped for independent operation for yard movements, such as turntable manœuvres, that may necessitate the separation of one unit from the other. The throttle, the reverse lever and the brake handle control all the movements required of the locomotive, and any movement of the throttle is relayed electrically to each power plant. An electro-pneumatic device actuates the engine speed governor of each engine to regulate the speed and output of each individual plant.

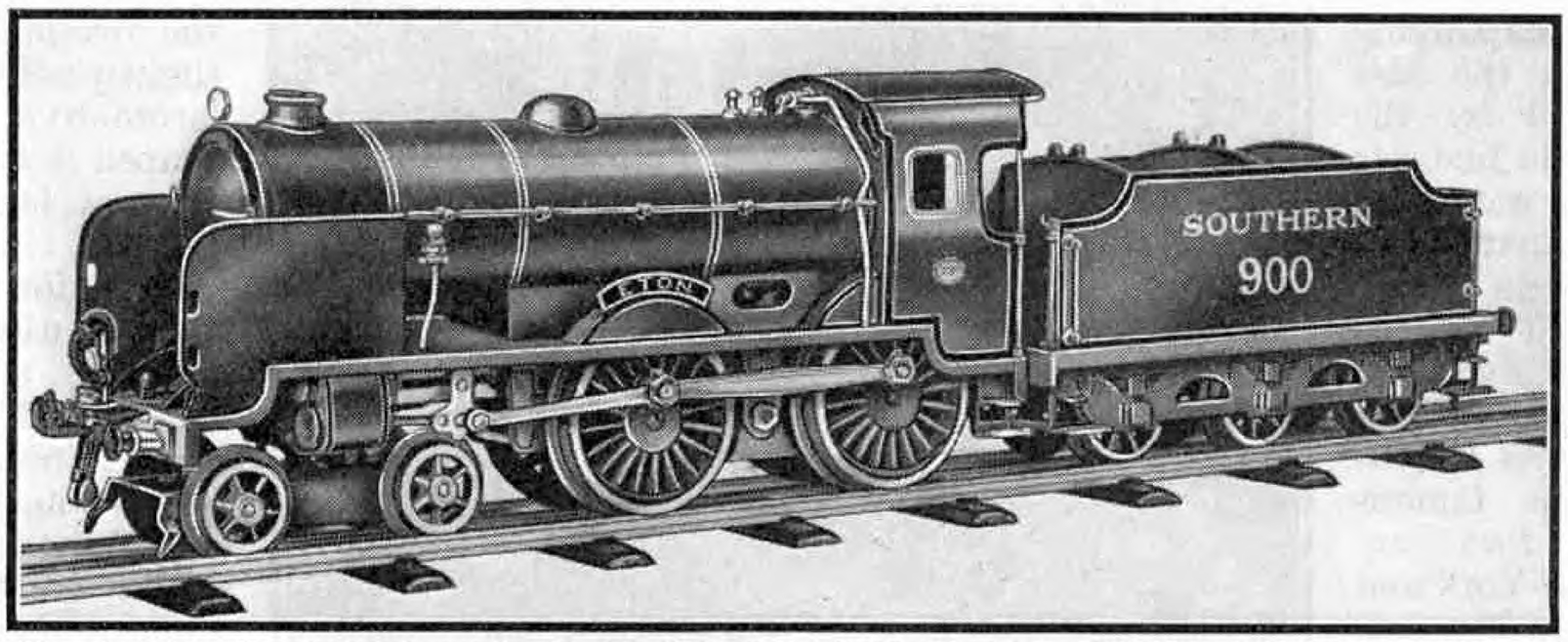
The second locomotive of this type to be delivered was exhibited at Atlantic City alongside the remarkable new Baltimore and Ohio steam locomotive *"George H. Emerson."* These two locomotives are seen in the illustration on page 454 of this issue. The wheel arrangement of the steam engine is 4–4–4–4, there being leading and trailing four-wheeled trucks with two four-coupled units between them, each unit being driven by a separate pair of cylinders. The engine has a water-tube boiler carrying a pressure of 380 lb. per sq. in. and a special design of superheater developed in the company's own shop.

A Hornby "Schools" Class Locomotive

Splendid New Model of S.R. *"Eton"*

THE recent introduction of the magnificent Hornby 4–6–2 *"Princess Elizabeth"* has now been followed by another splendid addition to the locomotives of the Hornby Series. This is a handsome model of the S.R. 4–4–0 No. 900, *"Eton,"* the pioneer engine of the famous "Schools" class. These locomotives probably are the most popular to be seen in the area served by the Southern Railway. The special purpose of their design, their handsome yet massive appearance and the work that they do all appeal strongly to the imagination, and there also is a special interest in their names, for each is named after a famous English public school.

As the photograph on this page shows, the new model bears a striking resemblance to the real engine and reproduces all its more prominent features. It is available for electric and for clockwork railways. The electric model is provided with a 20-volt motor that incorporates the famous Hornby Remote Control, which means that it can be started, stopped, controlled for speed and reversed without any handling of the locomotive itself. The clockwork movement is the well-tried No. 2 Special mechanism, which gives great hauling power and the maximum length of run.



The splendid new Hornby S.R. locomotive No. 900, "Eton," described in this article. The design of this handsome miniature locomotive follows closely that of the real engines of the popular "Schools" class.

The general design of the engine is very pleasing. The massive boiler with its characteristic fittings, the smoke deflectors at the front end and the typical cab all combine to give the effect of the real *"Eton"* in miniature. The amount of detail incorporated is remarkable. For instance, all S.R. model railway owners will be delighted to see that it carries miniature route-indicating discs. Most readers know that the S.R. do not make use of the British standard headlamp code, and that route-indicating discs are carried on their locomotives because of the complexity of their tracks. The miniature discs provided with the Hornby *"Eton"* locomotive enable owners of S.R. layouts to follow this practice exactly. The brackets for these discs at the front of the new locomotive are correct in number and position. Thus there is one on each side of the smoke-box door, a feature peculiar to S.R. practice and made necessary by the number of indications that have to be provided for, and there are in addition the usual three brackets above the buffer beam and one below the chimney.

The front of the model reproduces exactly the characteristic S.R. smoke-box, and smoke deflectors, or "down-draught" plates as they are termed officially, give the model an up-to-date appearance. The shape of the real plates is followed exactly, and the miniature deflectors even incorporate the two small slots in the front edge that provide hand-holds for the enginemen when passing round the front of the engine.

The chimney and dome are of squat modern design and the Ross Pop safety valves are smart little fittings finished in polished brass. There is a considerable amount of polished brasswork about the engine, and this adds to the smartness of its appearance. For instance, there are the clack boxes, one on each side of the boiler behind the smoke-box, by means of which the feed water from the injectors is introduced into the boiler of the real engine. These are modelled in a very realistic manner, as the photograph shows, and each is complete with a length of feed pipe that disappears below the footplate. From the characteristic steam turret and whistle mounting in front of the cab the whistle itself projects forward horizontally; and the two steam pipes that pass downward on each side follow the characteristic contours of the real ones.

A striking external feature of the design of the real "Schools" is the setting-in at an angle of the upper part of the side sheets of the cab. This was necessary owing to the restricted loading gauge of the Hastings route, for which the engines were primarily designed. This feature is reproduced effectively in the new Hornby locomotive and results in a very distinctive appearance. The cab is of the modern side-window type as fitted to the engines of the "Schools" class. It includes a die-cast fire-box back that projects into the cab, in which the regulator and various other fittings are represented. The fire hole door also is shown in relief.

The finish of the Hornby "Schools" class locomotive is splendid. Standard S.R. practice is followed, and the engine is attractively lined out in black and white. A smart detail that adds a splash of colour is the small oval number plate with its red background on the cab side. The nameplates, on the leading splashers, are particularly striking, the name *"Eton"* standing out well in gold letters on a red background. The edge of the nameplate also is in gold to represent the polished brass of the original.

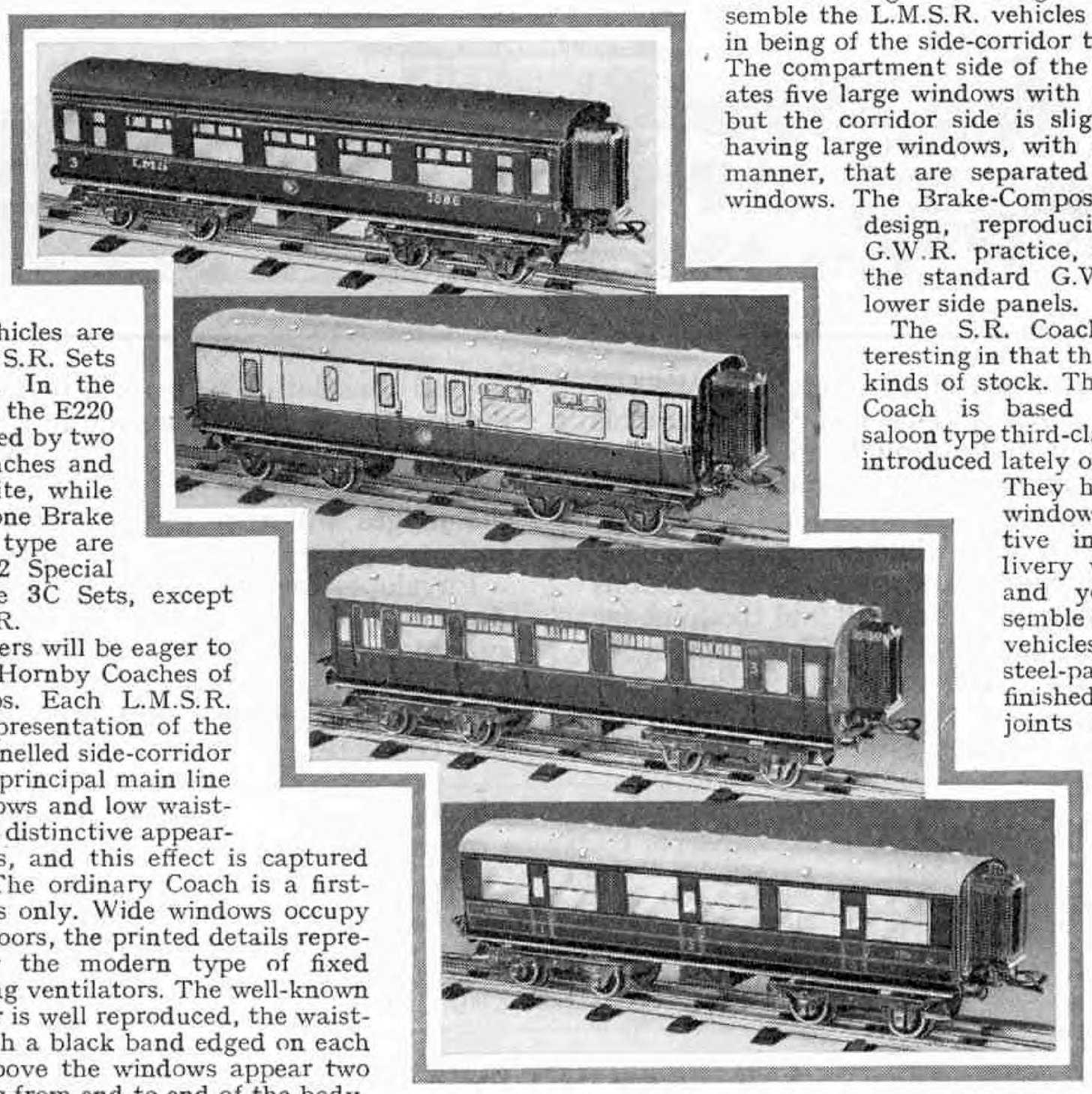
The tender is of standard No. 2 Special design and incorporates the main features of modern S.R. six-wheeled tenders. It is fully fitted up internally with the appropriate division plates, sloping coal space, water filler and brake handles.

New Corridor Coaches in the Hornby Series

By "Tommy Dodd"

AS the subject of my article this month I am giving details of the new Hornby No. 2 Corridor Coaches. Four of these splendid coaches are illustrated on this page. Altogether there are eight, two for each group. They are in the colours and style of each of the four main line railway groups and are similar in size and shape to the ordinary compartment-type No. 2 Coaches, their tinprinted sides and ends representing the very latest stock seen on British railways. The design of each has been laid out separately so as to reproduce its prototype exactly.

One of the two new vehicles for each group is an ordinary Corridor Coach and the other a Brake Composite. All are available separately for Hornby Train enthusiasts who wish to add them to their stock, and they are also being included in the Hornby E320 and E220 Special Train Sets, and in the No. 2 Special Clockwork Sets. There are two exceptions to this arrangement. These are the S.R. E320 and No. 3C *"Golden Arrow"* Sets. The real *"Golden Arrow"* is a Pullman service, and Pullman vehicles are therefore retained in the S.R. Sets representing this train. In the other E320 Set, and in all the E220 Sets, Pullmans are replaced by two of the new Corridor Coaches and one new Brake Composite, while one Corridor Coach and one Brake Composite of the new type are packed in all the No. 2 Special Clockwork Sets and the 3C Sets, except those representing the S.R.



This illustration shows the chief features of the new Hornby No. 2 Corridor Coaches described on this page. The colouring, detail and finish of these vehicles is representative of the latest standard practice.

Miniature railway owners will be eager to learn all about the new Hornby Coaches of each of the four groups. Each L.M.S.R. Coach is a wonderful representation of the latest steel-sided flush-panelled side-corridor stock now in use on the principal main line services. The large windows and low waist-line give a handsome and distinctive appearance to the real coaches, and this effect is captured exactly in the models. The ordinary Coach is a first-third, and has end doors only. Wide windows occupy the spaces between the doors, the printed details representing very accurately the modern type of fixed window with upper sliding ventilators. The well-known L.M.S.R. red body colour is well reproduced, the waist-line being picked out with a black band edged on each side with yellow; and above the windows appear two plain yellow lines running from end to end of the body.

The L.M.S.R. Brake-Composite is similar in general style and finish, so that a train of these vehicles has a splendidly effective and consistent appearance. The well-known L.M.S.R. Coat-of-Arms printed in colour in the centres of the lower side panels gives a very smart and realistic touch to the vehicles, and other attractive details are the destination board brackets fitted above the windows. Hornby Train Nameboards can be fitted to these in the latest L.M.S.R. style.

The ends are finished in black, as is now the latest practice on the L.M.S.R., and on this background the printed details show up very clearly. Among these are the steps and handrails, and the alarm apparatus appears on one end of each Coach, exactly as on the real coaches. Even such small items as the electric lighting cables or "jumpers" on each side of the corridor connections are represented in a realistic manner.

The L.N.E.R. coaches are equally attractive and realistic. They are modelled on the well-known teak-bodied side-corridor stock so characteristic of the East Coast Route, and even the effect of the grain of the wood, and the slightly differing shades typical of L.N.E.R. stock are reproduced. Other genuine L.N.E.R. features are the square-cornered windows and the plain rectangular mouldings. The effect is completed by the lining on the various mouldings, which is in cream colour and exactly follows actual L.N.E.R. practice.

The first-third Corridor Coach is illustrated on this page. The Brake-Composite has guard's and luggage accommodation, with first-class and third-class compartments. The ends of both these Coaches are finished in true L.N.E.R. style in similar colours to their sides.

The G.W.R. Coaches in this new set are designed to represent the vehicles recently constructed at Swindon for general main line service. The large windows of the prototypes have been faithfully reproduced, as have the smart brown and cream painting, and the neat lettering and lining. The Corridor Coaches resemble the L.M.S.R. vehicles I have already described in being of the side-corridor type with end doors only. The compartment side of the ordinary coach incorporates five large windows with upper sliding ventilators, but the corridor side is slightly different in layout, having large windows, with bars across in the usual manner, that are separated by three smaller drop windows. The Brake-Composite is of similar general design, reproducing exactly the latest G.W.R. practice, and both Coaches carry the standard G.W.R. monogram on the lower side panels.

The S.R. Coaches are particularly interesting in that they represent two different kinds of stock. The design of the ordinary Coach is based on the centre-corridor saloon type third-class vehicles that have been introduced lately on S.R. main line services. They have end doors and wide windows and look very attractive in their Southern green livery with the standard black and yellow lining. They resemble the L.M.S.R. and G.W.R. vehicles in that they represent steel-panelled stock with flush finished sides, and even the joints in the body panelling are represented, this feature being a characteristic of the real coaches.

The Brake-Composite is of the usual side-corridor type, and follows the standard "Ironclads," as the S.R. steel-panelled coaches are known. Its appearance is characteristic and the correctness of its detail is remarkable. For instance, the windows of the luggage doors are provided with a typical "grid" or arrangement of crossbars to prevent damage from luggage and in the bottom corner at the guard's end of the coach appears the legend "Load 3 tons," just as on the real stock.

The underframes and bogies of all the new Coaches are identical with those of the ordinary compartment-type No. 2 stock. Hornby Automatic Couplings of course are provided, together with lamp brackets and tail lamps. Except for the L.M.S.R. models, the roofs are painted white and carry brackets for Hornby Train Nameboards. Standard Hornby corridor connections are used, and one corridor connection and one standard end plate are packed with each Corridor Coach.

These realistic new Coaches allow miniature trains to be assembled exactly reproducing the famous expresses of real practice. Long-distance trains such as *"The Royal Scot"* of the L.M.S.R. or *"The Flying Scotsman"* of the L.N.E.R. can be made up with appropriate stock, and fast but shorter-distance flyers such as *"The Bristolian"* of the G.W.R. or an S.R. *"Kent Coast Express"* can be run equally easily.

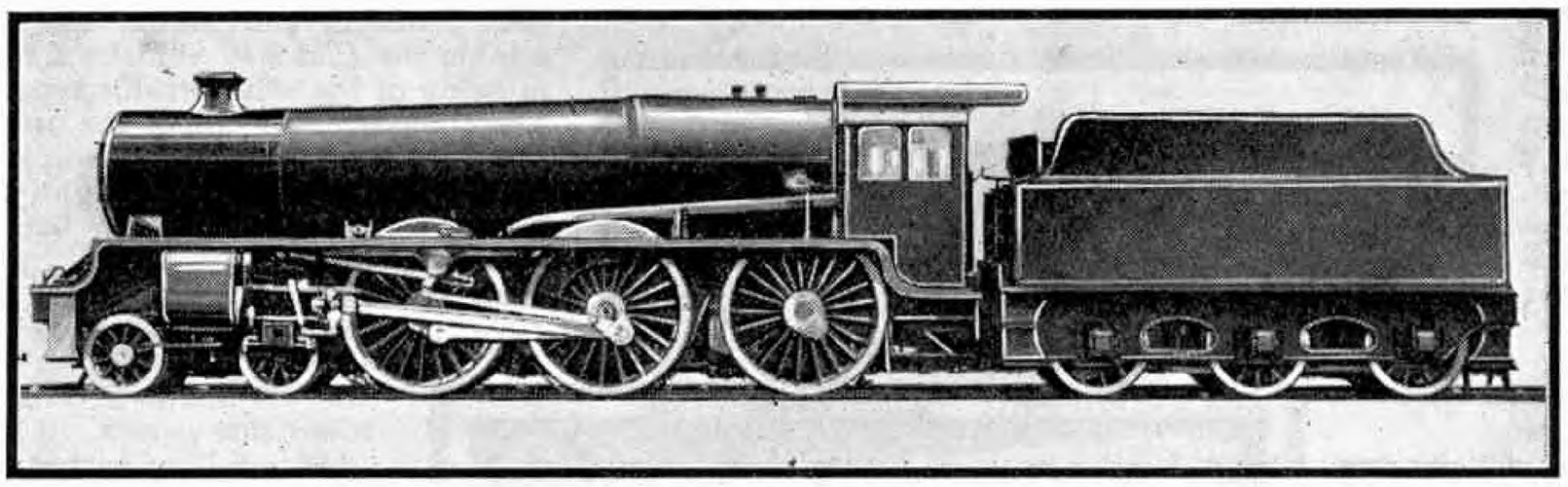
H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

A NEW SHARP-EYES CONTEST

Our competition this month takes the form of a puzzle that can be solved during holidays at the seaside or in the country, but at the same time will be attractive to H.R.C. members, all of whom are particularly interested in locomotives. On this page is an illustration of what at first glance seems to be an L.M.S. class 5X 3-cylinder 4–6–0 locomotive. Closer examination will reveal certain curious features, however, and the illustration really is the result of ingenious alterations that have been made by our artist to a photograph of one of these engines. We feel sure competitors will agree that he has carried out his work pretty thoroughly, for although no very minute parts have been taken out or added, the puzzle of finding what has been done needs sharp eyes for its solution.



Members are asked to find which components have been removed from the photograph, and what alterations have been made in design, and they will find the hunt for these both interesting and exciting. The number of changes is purposely not being revealed, so that competitors should look in every corner in order to track down as many unusual features as possible.

In setting out the list of missing components and alterations that have been made to the engine, competitors should give only the names of the portions they discover to have been taken out, and details of any alterations they detect should be kept as short as possible.

The contest will be divided as usual into two sections, Home and Overseas, and in each will be awarded three main prizes consisting of products manufactured by Meccano Ltd. to the values of 21/–, 15/– and 10/6 respectively. In addition several consolation prizes will be awarded to those competitors whose entries are meritorious, but do not quite reach the standard of those to which the three chief prizes are awarded. In the case of a tie for any prize, the judges will take into consideration the originality and general neatness of the entry.

Envelopes containing entries must be marked "*H.R.C. August Sharp-Eyes Contest*" in the top left-hand corner and addressed to Meccano Ltd., Binns Road, Liverpool 13. The closing dates are 31st August for competitors in the Home Section and 30th November for Overseas competitors.

Railway Photographic Contest

Our Summer series of Photographic Contests has produced many remarkably good entries, some of which will be published in future issues of the "*M.M.*" The holiday season now in full swing will give members ample opportunities for making use of their cameras, and wherever they may go they should keep a keen look out for possible subjects for the August Contest.

Any railway photograph, either large or small, may be submitted in these Contests, and one of an ordinary line or station scene will receive as much consideration from the judges as a photograph of a famous train at high speed, provided it is good and is of real railway interest.

Competitors may submit any number of prints, but the exposure of each must have been made by the competitor himself. The development and printing may be the work of a professional photographer. On the back of all prints must be written a short description of the scene shown in the picture, the competitor's name, address and his H.R.C. membership number.

This month's contest will be divided into the two usual sections, Home and Overseas, and the prizes in each will consist of products manufactured by Meccano Ltd., or if preferred photographic material, to the value of 21/–, 15/– and 10/6 respectively. Envelopes containing entries must be marked "*H.R.C. Photo Contest No. 5*" in the top left hand corner. Those in the Home Section must reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st August. The closing date in the Overseas Section is 30th November.

COMPETITION SOLUTION

"April Mystery Picture Contest"

(1) Class A4, 4–6–2, L.N.E.R. (2) Britannia Tubular Bridge, L.M.S. (3) Audible cab signal apparatus, G.W.R. (4) 4–8–4, No. 6400, C.N.R. (5) Driver's side of G.N. "Atlantic" cab, L.N.E.R. (6) Rail brakes. (7) Nord super Pacific Series Nos. 3.1251–3.1290. (8) Safety valves and cab vent, class A1, 4–6–2, L.N.E.R. (9) 12-ton covered goods wagon, L.N.E.R. (10) Colour-light route indicator. (11) Turbomotive, 4–6–2, L.M.S. (12) Hiawatha, 4–4–2, C.M.St.P. and P.R.R. (13) Corridor Tender, L.N.E.R. (14) Class 8, 2–8–0, L.M.S. (15) Michelin Type 33 articulated railcar. (16) The "Beetle," L.M.S. (17) Junction route indicator. (18) Streamline Tube Train, L.P.T.B. (19) Driver's side of "Schools" cab, S.R. (20) 2–6–2, High pressure Swiss locomotive.

COMPETITION RESULTS

HOME

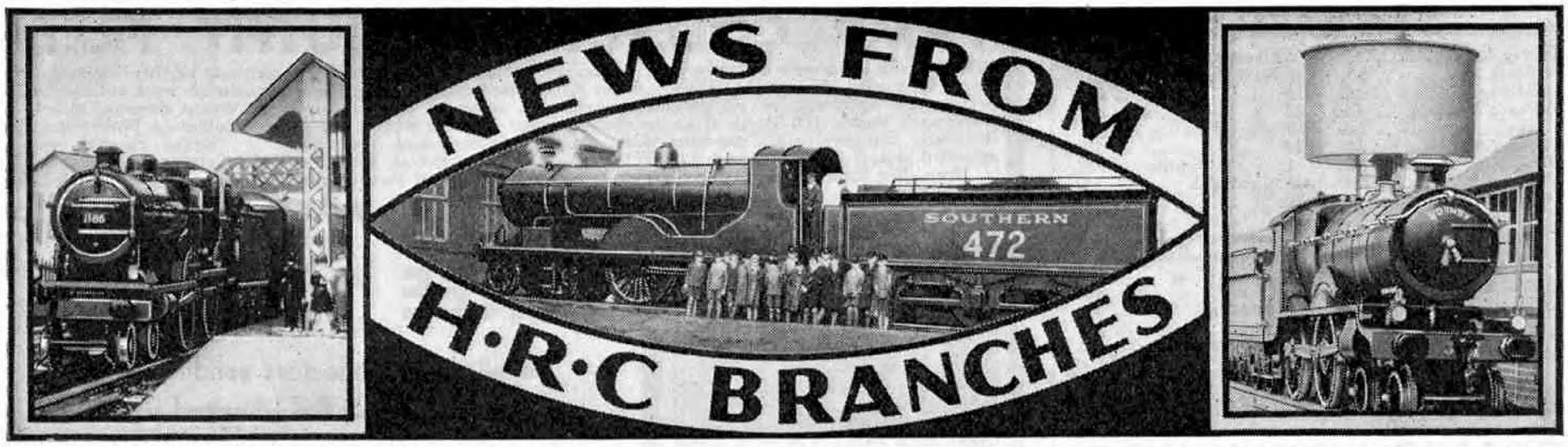
June "Mutilated Names Contest."—First: J. C. Button (10335), Crewe, Ches. Second: E. W. Ogle-thorpe (46851), Harrow, Middlesex. Third: G. Johnston (38784), Southall, Middlesex. Consolation Prizes: C. E. Wrayford (6039), Moretonhampstead, Devon; D. H. Wakely (17486), Cheam, Surrey; W. C. Hannon (53430), Carntyne, Glasgow, E.1.

June "Railway Photographic Contest No. 3."—First: D. Fear (18477), Taunton, Somerset. Second: D. F. Forbes (14092), Leith, Edinburgh 6. Third: H. S. G. Darke (4461), Hampstead Garden Suburb, London, N.W.11. Consolation Prizes: A. J. Banwell (33434), Oxhey, Watford, Herts.; S. Mackay (53505), Aberdeen; J. Turley (18853), Tunbridge Wells, Kent; J. R. Webb (25008), Maryport, Cumberland; R. A. O'Sullivan (26085), Belfast; E. W. Ogle-thorpe (46851), Harrow, Middlesex.

OVERSEAS

March "Locomotive Problem."—First: W. B. Moore (20918), Toronto 12, Ontario, Canada. Second: A. East (29968), MacAndrew Bay, Dunedin, New Zealand. Third: A. A. Shawky (53749), Giza, Orman, Egypt. Consolation Prizes: A. F. Emmerson (48076), Areymouth, New Zealand; G. E. Schulz (15425), Coromby, Victoria, Australia; A. R. Bacon (38242), Byculla, Bombay, India; A. McIntyre (30925), Winnipeg, Manitoba, Canada.

March "Articles Contest."—First: G. Yule (34970), Balwyn E8, Melbourne, Australia. Second: J. A. Rodriguez (3647), Montreal, P.Q., Canada. Third: J. J. M. Carter (49499), Observatory, Capetown, South Africa. Consolation Prizes: R. Myburgh (37538), Claremont, Cape Province, South Africa; D. Murison (37642), Buenos Aires, South America; W. Carpinter (42509), Sumner, Christchurch, New Zealand.



Branch News

ELMSIDE (EXETER).—The laying of the new Branch track has been completed, and an electric signalling system has been installed. A Coronation service of trains decorated in red, white and blue has been run. Dinky Toys Evenings held recently proved specially attractive to several new members, who were also keenly interested in shunting operations. Secretary: J. T. H. Fenwick, 28, St. John's Road, Exeter.

ST. STEPHEN'S (SALTASH).—Recent track meetings have chiefly been devoted to shunting. Games have been played at the close of each meeting. The last of a series of interesting talks dealt with *"Photography."* At one meeting members welcomed Mr. Ellis, Leader of the Plymouth M.C., and other members of this club, and Mr. Ellis kindly gave a Lantern Lecture on *"Modern Locomotives."* Secretary: B. Braund, 9, Homer Park, Saltash.

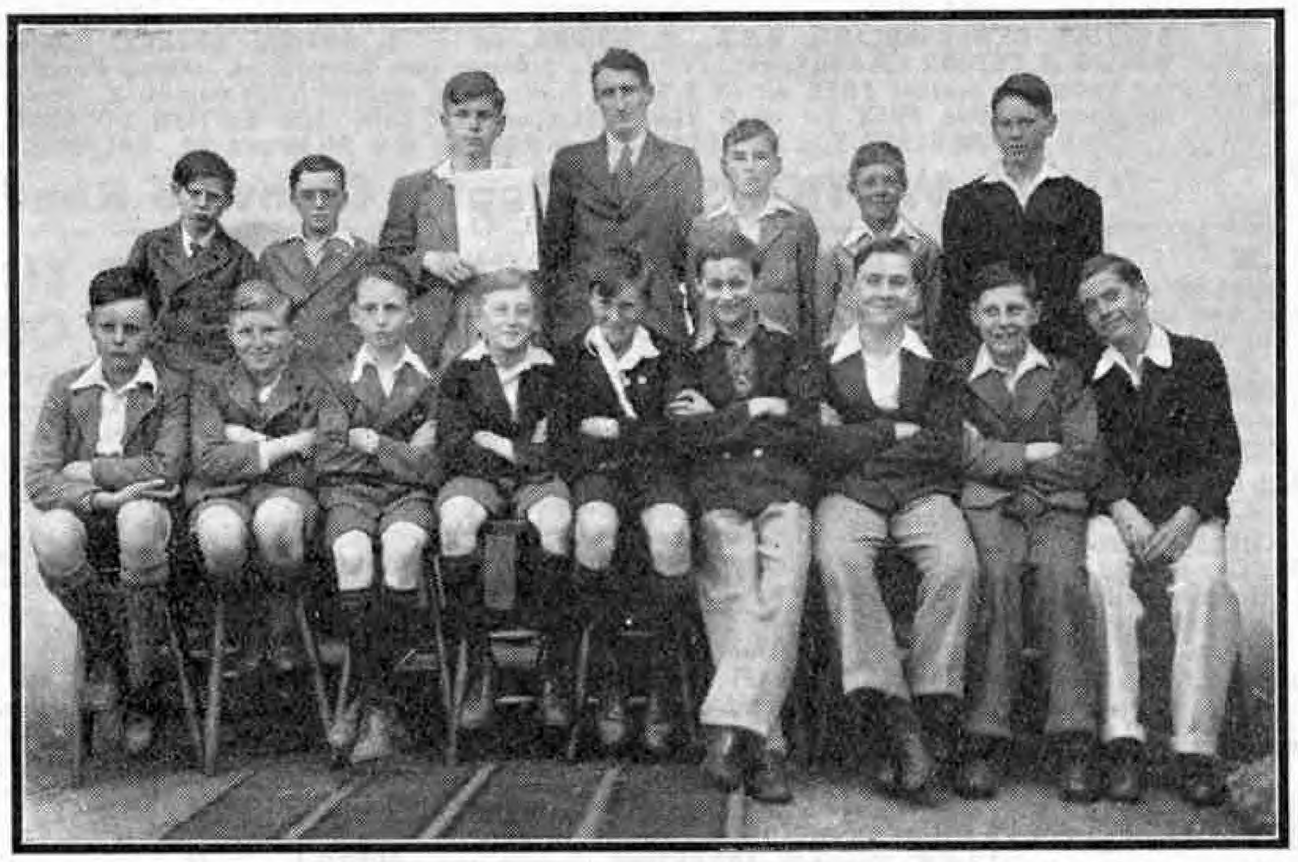
DOVER.—An increased membership has enabled three new pairs of points and two dozen straight rails to be added to the Branch layout. The terminal stations now have three platform faces instead of two, and additional sidings have been laid down alongside the engine shed. A new passenger coach, timber wagon and a signal have been placed in commission. Track meetings have been held in the open on extensive layouts. A visit has been paid to the Romney, Hythe and Dymchurch Railway. The Branch magazine has been enlarged. Secretary: D. F. E. Moore, 48, Folkestone Road, Dover.

HORNSEA.—Heavy passenger and goods services have been run at track meetings, the transport of cattle and farm produce being a special feature. A departure from normal practice was the inclusion of an advertisement coach on the *"Flying Scotsman"* express. Secretary: P. Richardson, "Summerleigh," Esplanade North, Hornsea.

FISHPONDS (BRISTOL).—The newly-laid Branch track has been found ideal for the high speed timetable of services recently introduced, an increased length of straight line lending itself admirably to fast, smooth running. Experiments have been carried out with slip coaches on through trains. A visit to the Bristol Locomotive Shed is being arranged. Secretary: A. W. Ewing, 154, Thingwall Park, Fishponds, Bristol.

ISLINGTON.—A recent Exhibition held in conjunction with the Islington M.C. proved a great success. The greater size of the new Branch room has enabled members to lay down an excellent and extensive track in addition to a Hornby electric layout. Attendances at recent track meetings has been good. Progress is being made in the construction of scale track. Secretary: A. D. Straker, 48, Onslow Gardens, Muswell Hill, M.10.

WANDSWORTH No. 1.—Particular attention has been paid to the social side of Branch life. Competition has been introduced in various forms, including a draughts championship, a "Spot the Ads" contest, and a photographic contest. Suitable awards, including free loan tickets for the Branch Library, are made to the winners of the various competitions. The Library now contains over 100 books, of which good use is made by members. An outing to Teddington Lock was greatly enjoyed, and it is to be repeated. Two stories have been submitted so far for the short film that is to be made this summer with the cine-camera. An invitation has been received to visit the local G.P.O., and it is hoped to take advantage of this. The first issue of the Branch magazine has been published, and great hopes are entertained for its future. Secretary: A. H. St. L. Walker, 68a, Oakmead Road, Balham.



Members of the Spring Grove Central School (Isleworth) Branch, No. 286, with their Chairman, Mr. K. Addinell, B.Sc. Meetings are held weekly in the School, when track operations on electric and clockwork layouts are enthusiastically carried out.

ST. GILES CATHEDRAL (EDINBURGH).—Over 400 ft. of electric track have been laid and ballasted, and appropriate scenic effects have been added. New electric points have been fitted and two stations built by members have been installed. Clockwork track with a length of 250 ft. has been laid. Models have been constructed of a Stephenson locomotive, a streamline American locomotive and the Electric Signal Control Box at Waverley Station. The Exhibition held in conjunction with the Meccano Club was open for two weeks, the event being "launched" by the Right Hon. Lord Salvesen, P.C., L.L.D. Secretary: A. Nicholson, 132, Trinity Road, Edinburgh.

FIRST SHEFFIELD.—Scenic effects on the Branch layout are being improved and a tunnel is under construction. Members enjoyed an interesting evening excursion to Nottingham, behind an L.M.S. Class 2 locomotive. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield 8.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation, and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below.

BARNEHURST—G. V. Clinch, 5, Stephen Road, Barnehurst, Kent.
BUNGAY—K. G. Stuart, 22, Upper Olland Street, Bungay, Suffolk.
CANADA—H. M. Brown, 277, Glidden Avenue, Riverside, Ontario.
LEICESTER—M. Smith, "Clovelly," Kirkland Road, Braunstone.
LEWES—D. Moore, 14, St. Swithun's Terrace, Lewes, Sussex.
ROBY—A. D. G. Johnson, "Brockton House," Church Road.
MALMESBURY—E. K. Lockstone, 6, Oxford Street, Malmesbury, Wilts.
NORTHAMPTON—T. Garlick 35, Colwyn Road.
PRESTWICK—S. McBride, 18, Meiklewood Avenue.
SOUTH CROYDON—I. Nelson, Hillside Orchard, Selsdon Vale.
THORNTON HEATH—R. H. Smart, 14, Kensington Avenue.
ULVERSTON—A. Thompson, 5, Cavendish Street.

SETS (Postage Extra)

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5	Salvador ... ... 2d.	10	,, ... 6d.
10	,, ... 4d.	1	,, Jubilee ... 3d.
15	,, ... 6d.	5	Nicaragua ... ... 2d.
4	Sierra Leone ... 3d.	10	,, ... 4d.
1	,, ,, Jub. 3d.	15	,, ... 6d.
5	Siam ... ... 2d.	10	Norway... ... ... 2d.
10	,, ... 4d.	5	Newfoundland ... 2d.
15	,, ... 6d.	10	,, ,, ... 5d.
3	Soruth ... ... 6d.	1	,, ,, Jub. 4d.
5	Straits Settlements 2d.	20	Sweden ... ... 2d.
10	,, ,, ,, 5d.	50	,, ... 1/-
5	Sudan ... ... 3d.	20	Switzerland ... ... 2d.
5	Tunis ... ... 3d.	50	,, ... 1/-

J. RUSSELL,
23. SHANKLIN DRIVE, WESTCLIFF-ON-SEA.

SPANISH CIVIL WAR

CENSORED COVERS franked with 4 "temporary" stamps authorised for postal use in Nationalist (Gen. Franco) Territory (Fiscals, Locals, Charities, etc. in various combinations, properly postmarked) at **1/6** per cover (or 10 covers, different assortments guaranteed, for **12/6**).

do. franked with Gen. Franco's definite issue (1, 2, 5, 10, 15, 20, 25, 30, 40, 50c. and 1 peseta values), superb used **7/-**.

Mint set of 9 ditto, 1c. to 40c. values inclusive, at **1/9**
,, ,, ,, 2 ditto, 50c. and 1 peseta values, at **1/9**
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Whether you are a new collector or a seasoned Philatelist, you will find the contents of this wonderful advertising offer of great use. They include: Ruled Duplicate book, in which is incorporated a millimetre perforation measurer, 34 all different stamps (no common Germans), pkt. of stamp mounts, metal watermark finder, 100 Titles of Countries. Amongst the fine stamps are sets of Colonials, Philippines, Bohemia, Hungary, old Canadians (King George), Indians and Australians, Swiss. Finally, two splendid sets, 5 LATVIA and 5 ESTHONIA. Complete parcel, including 1937 Catalogue, absolutely free. Just send 2d. postage requesting approvals and list of further gifts.

LISBURN & TOWNSEND LTD. (Dept. M.M.), LIVERPOOL 3



FREE 4 CORONATION COLONIALS

To all stamp collectors sending **2½d.** postage (abroad **6d.**) Limited supply.

G. P. KEEF, Willingdon, Eastbourne

THE KING EDWARD VIII 2½d.

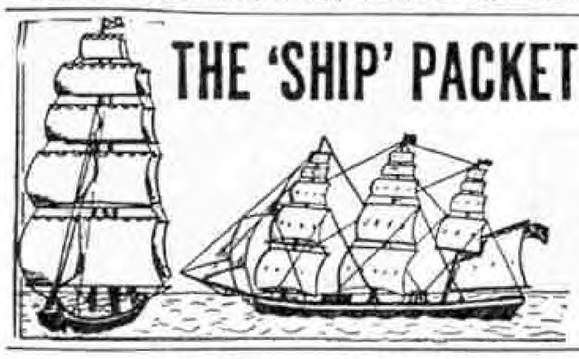
is a scarce stamp, and should be in every collection. During August one of these stamps will be used for postage on every **"DIAMOND" PACKET**, which contains approx. **1,000 UNSORTED STAMPS** from Convents abroad. **MANY RARE STAMPS** have been found in it. 1 pkt., **1/6**; 3 pkts., **3/9**; 5 pkts., **6/-**. All post free inland.

Postage to Colonies 3d. per pkt. extra. Foreign, 6d. extra.

Ask your stationer for the "Diamond" packet.

SPECIAL: TURKS ISLANDS JUBILEES complete set, unused or used, **5/6.**

O. NERUSH (Dept. A), 68, TURNPIKE LANE, HORNSEY, LONDON, N.8.



THE 'SHIP' PACKET

This marvellous packet is offered under cost as an advertisement, **45 different stamps each with a ship on it.** A regular armada. **KOUANG-TCHEOU,** new, **SENEGAL** (Canoe), wonderful flotilla of caravels from **DENMARK** (complete set), **NEW CALEDONIA, UKRAINE, COSTA RICA,** a fleet of **7 CHINESE** junks usually sold at 10d., **TRINIDAD & TOBAGO, MAURITIUS, KENYA-TANGANYIKA, NEWFOUNDLAND, U.S.A., B. GUIANA,** set of **S. AFRICA, GREECE, POLAND, INDO CHINA, FRENCH OCEANIA, WALLIS & FUTUNA ISLANDS,** etc. Price **4½d.**, postage 1½d. (abroad 3d. extra). Purchasers of this packet asking for approvals receive **FREE** set of **3 SPAIN** (Columbus, each with his ship on it). Senders of addresses of stamp collectors receive **FREE** set of **6 VENEZUELA or 6 PERSIA, 100 BRITISH COLONIALS 1/-, 20 AIRPOST 6d., 6 TRIANGULARS 7d., 50 PERSIA 4/-, 9 POLAND New Pictorials 8d., VOLUMES OF B.O.P. CHEAP.**





H. C. WATKINS (M. Dept.), Granville Road, BARNET

CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP, 26, WINDSOR ROAD, BRISTOL, 6.

CORONATION OFFERS

ALL DIFFERENT PACKETS—10 at **9d.**; 15 at **1/3**; 20 at **2/-**; 45 (One stamp from each Colony) **5/3.**

MINT SETS (Stock) New Zealand, Niue **1/2**; Nauru **2/-**; South Africa **4/6**; Australia (2) at **5d.**; Canada **2½d.**; Morocco (3) **5d.**; Br. Solomons **9d.**; Caymans **6½d.**; Mauritius **10½d.**; St. Lucia, St. Vincent **8½d.**; St. Helena **10d.** Lists on request.

MOROCCO K.E. VIII Complete Mint **1/3**; Used **1/9**; 6 K.G. VI **4½d.** Cash with order. Postage extra.

T. R. HUGHES, 'Ibis Cottage,' Amersham, Bucks.

CORONATION BARGAINS

FREE to all approval applicants **SET** of latest **GEORGE VI CANADA.** Mint Coronation Sets: **MOROCCO 6d.; AUSTRALIA 4d.; NEWFOUNDLAND 8d.; N. RHODESIA 10d.; S. RHODESIA** (1d. and 2d.) **1/6; ADEN 1/-.** First Day Covers of most Colonies and Dominions in stock, including **ANTIGUA 2/-; FALKLANDS 2/9; NIGERIA 2/-; NEW ZEALAND 3/6; CANADA 8d.**

Geoffrey E. Walker, Rookley, Solihull, Birmingham.

7 Different Mint and Used Coronation Stamps from Crown Colonies and Dominions

FREE

includes Canada, Australia (Complete Set), S. Africa (pair English and Afrikaans), Morocco Agencies, French Zone Mint, and Malta.

A unique opportunity to obtain these fine stamps free. Send to-day enclosing 2d. for postage, and this Coronation free gift will be sent to all genuine applicants requesting approvals.

K. Humphries, Dept. M, 39, East St., Chichester, Sussex.

FURTHER MINT CORONATIONS IN STOCK

Aden	1/-	Mauritius ...	9d.
Barbados ...	7d.	Morocco Ag.	6d.
Bechuanaland	9d.	Nauru	2/-
Bermuda ...	7d.	St. Vincent ...	8d.
Br, Solomans	9d.	Seychelles ...	9d.
Gilbert & Ellice	9d.	Straits Sett. ...	10d.

Others as in July advert.

Cash with order. Postage extra.

H. L. Gomm, 41, Upper Cranbrook Rd., Redland, Bristol, 6.

WILLIAM TELL

This giant packet of 25 different stamps is **ABSOLUTELY FREE** and includes **SWISS** set depicting William Tell and his Son (with famous crossbow and apple split by arrow) and bicoloured statue of Helvetia. Other allegorical stamps include set **PORTUGUESE COLS.** (Ceres); set **GREECE** (Hermes); set **GERMANY** (Germania); **TRINIDAD** (Britannia); **I.F.S.** (Sword); **ARGENTINE** (Commerce); **CRETE** (Crete enslaved); set **FRANCE** (Blanc, Sower, Mouchon, Peace & Commerce); **NEW ZEALAND; GEORGIA** (St. George on horse), etc. All these can be yours **FREE** by sending 2d. stamps for post, etc., and requesting approvals.

WINDSOR STAMP CO.
(Dept. M), 59, LEE ROAD, BLACKHEATH, S.E.3.

5 MINT CORONATION STAMPS FREE. Postage 2d. Sanders, 90, Newlands Avenue, Southampton.

JAMBOREE PACKET FREE

Special stamps have been issued for the Scouts World Jamboree, held this month in Holland. This fine packet will contain one or more stamps from this set together with Colonials and other scarce items. Don't be a "TENDERFOOT" and miss this fine offer. "BE PREPARED" and write now, enclosing 2d. in stamps, requesting "FIRST CLASS" approvals from

G. KINGSMILL (Dept. MM), NEW BARNET, HERTS.

Special Mint Set of 3 (1½c., 6c., 12½c.), Post Free 10d.

ONE THOUSAND STAMPS ON APPROVAL

From which you may select any 100 for 3/-.

This selection is not made up of the very commonest varieties, but contains stamps catalogued at 1/- each or more. (I do not sell less than 100.)

A returnable deposit of £1 is required from overseas applicants.

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CORONATION GIFT

To all applicants sending 2d. and requesting approval sheets we offer a stamp collector's outfit, consisting of Gem Case, Mounts, Transparent Envelopes, Packet of stamps including CORONATION STAMPS, and other new issues.

This offer is for 30 days only, abroad 60 days.

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Dept. 264, South Hackney, E.9. Established 1880.

FREE 'ASTRID' PACKET

A magnificent gift of over 60 stamps including large mint **BELGIUM** (depicting late QUEEN ASTRID holding Baby Prince), **GUINEA** (mint), scarce mint **PARAGUAY,** fine set **6 FRENCH COLONIES** large mint pictorials, **ROUMANIA** (Air Mail) mint, etc. All absolutely FREE to genuine applicants for my high-grade approvals enclosing 1½d. for postage.

G. F. PORTER,
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Send Coronation and Colonial pictorials, will return like value in U.S. Commems. Use pict. postage. M. W. Hare, Reedley, Cal. U.S.A.

SPECIAL AUGUST HOLIDAY OFFER. FREE Stamp Wallet (with perforation gauge) containing 30 stamps including **mint coronation.** Send 2d. postage. Request approvals.—Else, Carnarvon Grove, Sutton Road, Huthwaite, Notts.

CORONATION PACKETS TO SUIT ALL POCKETS

8 Different, 9d. 17 Different, 1/6. 24 Different, 2/4.
36 Different, 3/5. 42 Different, 4/3.

One Variety from each of the 45 Colonies (45) Stamps **5/-**
135 Different (3 from each of the 45 Colonies) complete **£1/7/6**
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Cash with Order. All Postage Extra.

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EDWARD SANDELL — 10, EVELYN GROVE — SOUTHALL, MDDX.



Stamp Gossip

and Notes on New Issues



Coronation Stamp Error

We wonder how many of our readers have noticed a curious feature in the Orb shown on the G.B. Coronation stamp.

Comparison with authentic pictures of the King's and Queen's Orbs used at the Coronation ceremony reveals that the stamp orb differs from them both in that it shows a band of precious stones running



vertically from the encircling band to the foot of the Cross at right angles to the Cross. In the real Orbs the vertical plane of this half-circle is the same as that of the Cross.

Comparison of the Orb on the British stamps with that shown in the design for the Crown Colonies stamp immediately shows the error if, as *"Gibbons Stamp Monthly"* says, it is an error, for there is just a chance that this portrayal is one permitted by convention. The Orb is depicted in this style in the 1876 Orb watermark of Great Britain and in the 1935 Silver Jubilee stamps of India.

French Railway Pictorials

The 13th International Railway Congress, which has been held this year in Paris, has been marked by the issue of two commemorative stamps, bearing designs that will be of interest to all railway enthusiasts among our readers.

Both stamps are illustrated here. The 30c. shows a modern electric locomotive, while the 1 f. 50 provides a striking impression of a streamlined "Pacific" type locomotive.

* * * *

An interesting special stamp, exclusively for use on letters posted in Czecho-Slovakia for destinations within the countries of Czecho-Slovakia, Jugo-Slavia and Roumania, has just been issued.



The principal feature of the design shows Prague Cathedral, but more interesting points are three linked rings at the foot, signifying the Little Entente formed by the three countries, and the label at the head which reads *"Ceskoslovensko—Petite Entente."*

A short while ago overprinted stamps were issued in Roumania to serve in the same way for mail posted in Roumania.

Empire Mails by Air

In a stamp article in the March 1930 issue under the title *"Airways are Mailways,"* we made the forecast that the time was rapidly coming "when all mails will be carried by air over both land and sea, except on the shortest journeys." As the years have passed, one country after another has adopted air transit as standard for its first-class mail. For quite a long time all European mail originating in Holland has been sent forward by air, and a great part of Britain's inland letter mail is now air-borne.

The greatest step forward, however, has been the decision that in future all letters passing between South Africa and Great Britain shall be carried by air without extra charge. At first this service is bound to call for a fairly substantial subsidy, but it is expected to become self-supporting within a comparatively short time.

It may be taken for granted that the success of this scheme will inevitably lead to similar arrangements for the Indian, Malayan, Australian and New Zealand mails. The carriage of Canadian and U.S.A. European mails by air as a result of the establishment of a regular transatlantic air service also is a possibility of the very near future.

A Stamp Photographic Contest

Readers who are camera enthusiasts, as well as stamp collectors, will be interested in a photographic competition promoted by *"Gibbons' Stamp Monthly"* for photographs illustrating the title *"The Young Philatelist."*

A specially interesting feature is that the prizes, consisting of stamp goods to be chosen from Messrs. Stanley Gibbons' catalogue, will range from two guineas upward, according to the number of entries. The photographs must have been taken by the entrants and the closing date is 30th September. Full details of the competition are given in the July issue of *"Gibbons' Stamp Monthly"* and interested readers who have difficulty in obtaining a copy of that issue should apply to the Editor, *"Gibbons' Stamp Monthly,"* 391, Strand, London, W.C.2.

* * *

Australia is to mark the 150th anniversary of the founding of the State of New South Wales, which falls in October next, by the issue of three commemorative stamps, 2d., 3d. and 9d. denominations.

The stamps are to appear on 12th October and a special first-day cover will be published for stamp collectors' use.

Danish Silver Jubilee Issues

The Silver Jubilee of King Christian X of Denmark, which was celebrated during our own Coronation week in May last, has been marked by the issue of a short set of four commemorative stamps.

We illustrate the 5 öre value, which has for its design a view of Marselisborg Castle, the royal summer residence, which lies close to the city of Aarhus in Jutland. In the foreground there is a racing yacht, representative of the King's yachting interests.



The design for the 10 and 30 öre values, also reproduced here, shows King Christian riding on horseback in the streets of Copenhagen. This undoubtedly will be the most popular design of the series, if only because it illustrates the King's democratic way of life. He is frequently seen moving alone about the streets of his capital.

The remaining stamp of the series, the 15 öre value, shows a view of Amalienborg Palace, King Christian's Copenhagen residence.

The Jubilee was marked in Iceland by the issue of a series of three stamps, 10, 30 and 40 aur values. Each of these stamps bears a portrait of King Christian.



Colombian Anniversary Stamps

The 400th anniversary of the founding of the city of Bogota, Colombia, will be celebrated next year, and a short series of three commemorative stamps is to be issued to mark the occasion.

One of the stamps will bear a composite design showing Jimenez de Quesada, the founder of Bogota, and the Indian ruler of the territory at the time of the conquest by Spain. The portraits will be flanked by a representation of a coffee plant on the left and of a maize plant on the right, symbolic of two of the country's principal crops. In the centre, between the two portraits, there will be a representation of an ancient Indian stone idol with a cross rising behind it.

The other two designs will show views of ancient and modern Bogota respectively.

* * * *

Readers in the United States of America will be pleased to learn that there is every prospect of the relaxation of the present American regulations prohibiting the reproduction of U.S.A. stamps in publications produced in the U.S.A.

A Bill now pending in Congress seeks to abolish the regulation.

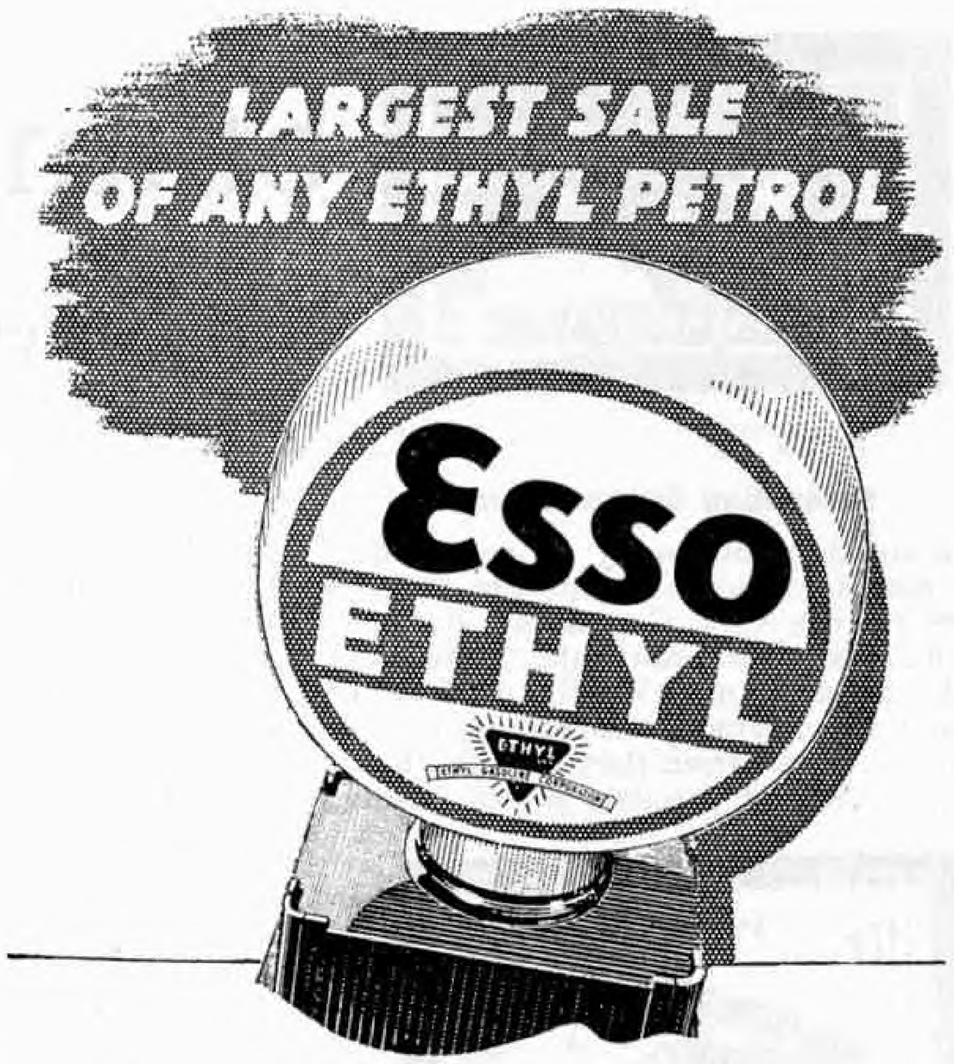
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Readers are urged to observe the following points when writing to advertisers:

1. **Mention the "M.M." and any special reference number quoted in the advertisement. This helps the advertisers to give prompt attention.**
2. **See that the full amount of the price and any postage is included. It is unfair to expect advertisers to fulfil their undertakings promptly if short remittances are sent.**
3. **GIVE YOUR FULL ADDRESS.**

THE ADVERTISEMENT MANAGER
MECCANO MAGAZINE, Binns Road, LIVERPOOL 13

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Factory for spraying
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Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect. Price 3/6

Meccano Ltd., Binns Road, Liverpool 13.

How to obtain the "M.M."

The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall. Price 6d. per copy. Direct subscriptions to this office will be at the rate of 4/- for six, or 8/- for twelve issues. As a rule, back numbers cannot be supplied, because we print only sufficient copies to fill our standing orders. To prevent disappointment, therefore, place a regular order either with your dealer, newsagent, or direct with this office.

Meccano Magazine, Binns Road, Liverpool 13.

100 DIFFERENT STAMPS FREE to applicants for ½d. approvals. Cox, 14, Broadmead Av., Worcester Park.

● FREE ●

Complete **MINT SET** of **MOROCCO CORONATION STAMPS** to all applicants for Approvals enclosing 2d. postage (Abroad 6d.)
Limited Supply.

A. W. NORMAN,
25, Kynaston Crescent, Thornton Heath, Surrey.

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There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.



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Meccano Ltd., Binns Rd., Liverpool 13

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Every owner of a Hornby Speed or Racing Boat who prides himself on taking care of his model should obtain a Hornby Boat Stand on which to place his boat when it is not in use. The Stands are available in the following sizes: No. 1 for No. 1 Speed Boats; No. 1R for No. 1 Racer; No. 2 for No. 2 Speed Boat and No. 2 Racer; No. 3 for Nos. 3, 4 and 5 Speed Boats and No. 3 Racer. They can be obtained from any Meccano dealer price 9d. each (any size).

MECCANO LTD., Binns Road, Liverpool 13

MECCANO LUBRICATING OIL

Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.



Meccano Ltd., Binns Road, Liverpool 13.

Holiday Bargains

During the next few weeks many of our readers will be taking a cruising holiday. They alone, perhaps, among holiday-making stamp enthusiasts will have their stamp collections actively in mind, for they may find excellent opportunities of acquiring new specimens.

A word of advice therefore may be useful to them. They should buy stamps only from post offices and obviously reputable stamp shops, not from itinerant

vendors. The stamp journals last autumn contained many letters from stamp collectors who had bought from such vendors, only to find that they had been "stung," packets of stamps that had been offered as "bargains" containing little else but rubbish.

Interesting odd lots occasionally are to be found in out of the way places both at home and abroad, however, and holiday makers will find it worth while to keep their eyes open for such lots. Four years ago, we found a bargain in a general shop in a village on the North Wales coast.

We had asked for a picture postcard view of a particular spot. The shopkeeper "thought she might have an old one" and started rummaging among some packets in a box. As she turned the packets over we saw three very soiled packets of stamps. On enquiry we found that they had been in stock since before the war. There had never been any demand for them and we were offered them for 2d. each, although their price was really 6d.

The sequel to this story should have been the discovery in the packets of several Cape Triangulars and Sydney "Views." There was nothing quite so thrilling as that, but there were many useful stamps that helped to make those packets the best sixpennyworth we ever bought.

U.S. Navy and Army Issues

This month we are able to illustrate the 5c. values in the United States parallel series of Army and Navy commemoratives.

The 5c. Army stamp shows composite views of the buildings at the West Point



Military Academy. The Navy stamp is, perhaps, the more interesting, for it shows naval cadets in old time and modern uniform.

* * * *

Stanley Gibbons Ltd. ask us to remind our readers of the importance of placing their orders early for the new season's catalogues that are to be published on 1st September.

Egypt's King Farouk Issues

The rush of British Coronation issues has tended to obscure the forthcoming Egyptian issues bearing the portrait of King Farouk, an event that is the more interesting to stamp collectors by reason of the great philatelic interests of the late King Fouad.

The new stamps, ranging in value from 1 mil. to 20 mils., are to appear on the first of this month. The design shows a squared-up portrait of King Farouk in morning dress and wearing the fez. The straight edges bordering the portrait are carried out to the edge of the stamp, and the corners, printed with plain ground in the same colour as the portrait background, are left blank. The top and side panels have a plain ground contrasting with the principal colour of the stamp and bear the wording *"Postes d'Egypte"* in Roman characters at the foot and in Arab script at the head. The figures of value, also in Roman and Arabic numerals, are placed level with the King's forehead on each side of the stamp. The design is very effective and strikes an entirely new note in stamp design.

Incidentally Egypt has in preparation four series of commemorative stamps to mark the forthcoming Cotton Congress, the Abrogation of Capitulations Conference, and the Ophthalmic and Wireless Congresses.

New South West Africa Issue

Readers who are forming collections of stamps illustrating transport methods,



will welcome the new South West African 1½d. issue, illustrated here.

The design of this stamp, it is officially explained, is intended to show the three modern methods of mail transport, by sea, land and air. As usual in the stamps of South West Africa and the Union of South Africa, the inscriptions are bilingual, alternate stamps bearing inscriptions in Afrikaans and English.

* * * *

We are indebted to Mr. L. T. Chapman of Christchurch for a souvenir cover commemorating the official opening of the new Chief Post Office at Dunedin, N.Z., on 14th April last.

All mail posted from this office on that day bore the special cancellation mark "Opening of New Chief Post Office, Dunedin, 14. Ap. 37.

* * * *

The King George VI issues for Mauritius and Nyasaland are in preparation. We understand that the designs will be the same as those of the existing series, with the substitution of the portrait of King George VI for that of King George V.

Several other colonies contemplate using existing designs for their King George VI stamps, and we cannot help thinking that this is indeed a pity. Imagine what a page of an album will look like with two such sets following one another! At first sight, both sets will look monotonously alike.

India's New Stamps

It is expected that four of India's new series of stamps bearing the portrait of King George VI, the 3p., 6p., 9p. and 1a values, will be placed on sale this month. In many ways these stamps will be entirely different from previous Indian issues, although the King-Emperor's portrait will continue to be the principal feature.



The new stamps will have the King-Emperor's portrait in the centre as the principal feature, but otherwise the designs will differ considerably from previous Indian types. Instead of being contained in an oval, the portrait will be framed by a pointed arch, symbolic of the country's characteristic architecture. The portrait will show head and shoulders in order that more of the beauty of the Imperial robes may be displayed.

The value tablets will appear at the foot of each side of the arch surround. The corners left at the top by the sweep of the arch will be filled by a lotus bud emblem, with a small amount of scroll work of varying form.

The designs for the high values have been forwarded to London for inspection by the King. These will follow previous styles very closely, but it is intended to use rather richer and more distinctive colourings.

* * * *

The centenary of the foundation of Athens University has been celebrated in Greece by the issue of a 3 drachmae commemorative stamp. The design, illustrated here, shows a figure of Minerva the Goddess of Wisdom and Industry, and in the background a Greek temple, from which rays of light are bursting, presumably to represent the Dawn of Learning.

Danube Centenary Stamps

The centenary of the Danube Steam Navigation Company, celebrated in June last, has brought three commemorative



stamps from Austria. In each case one of the popular steamers plying on the Danube has been chosen for illustration, and we show here the 12 gr. value with a picture of the steamer *"Maria Anna."*

The other designs are as follows: 24 g. the *"Franz Schubert"*; 64 g, the *"Oesterreich."*

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.



OBLIGING!

Customer (suspiciously): "I see you have placed all the best tomatoes on the top."

Grocer: "Yes, ma'am. We do that to save you the trouble of hunting through the box for them."

* * * *

Teacher: "What is the chief river of Egypt?"
Johnny: "The Nile."
Teacher: "And what are its tributaries?"
Johnny: "The juveniles."

* * * *

A door-knob is a thing a revolving door goes around without.

* * * *

Arriving at church one Sunday a man found a stranger sitting in his seat: "Excuse me, but you're occupewing my pie," he said.

"I'm sorry," said the stranger, "but I was sown into this sheet."

* * * *

Manager: "You can have a job in the box-office during the run of our play. All you've to do is to take the money."

Old Actor: "Thanks! What about a little rehearsal now?"

* * * *

"Do you think you increased your circulation by giving a year's subscription for the biggest potato raised in the country?"

Editor of gardening paper: "Maybe not, but I got four barrels of samples."

* * * *

Mother: "Off you go to bed without your supper."

Tommy: "Hurrah! No medicine, then! It says I'm to take it after meals."

* * * *

Prof.: "Dear me, this is very distressing."

Daughter: "What is it, Dad?"

Prof.: "I gave a pupil a special course in memory training. Now he has forgotten to pay me and I cannot remember his name."

* * * *

TAKING NO CHANCES

Quiggle: "Do you ever pause and reflect on the opportunities you have missed?"

Wiggle: "No. It would be just my luck to miss some more while I was reflecting."

* * * *

Housewife: "But, my good man, your story has a very hollow ring."

Tramp: "That comes from speaking on an empty stomach."

* * * *

"That seems a nice kind little boy of yours, Mrs. Prune," said the visitor, watching a boy who was fondling a cat. "What are you going to make of him when he grows up?"

"Well, miss," said Mrs. Prune, "seeing that he's so fond of animals, we were thinking of making him a butcher."

* * * *

PROFESSIONAL PRIDE



Burglar (about to give son a thrashing): "Mind you, this is not so much for pinching the jam, as for the careless way you've left your fingerprints about."

LEFT SPEECHLESS!

The class had been asked to write an essay entitled "The funniest thing I ever saw."

Jack finished very quickly, so the teacher asked to see his attempt.

"The funniest thing I ever saw was too funny for words," she read.

* * * *

Draper: "These are especially strong shirts, sir. They simply laugh at the laundry."

Customer: "I know that kind; I had some which came back with their sides split."

* * * *

Teacher: "And what do you know about Cologne?"

Bobbie: "Please miss, that's where the odour comes from."

* * * *

A MISUNDERSTANDING



Convict: "When does the fun begin?"

Warder: "Fun? What fun?"

Convict: "Well, the judge said I was to come here for the time of my life."

* * * *

Chemist: "You might have charged that young man five shillings for making up that prescription. Why did you put the price at one shilling?"

Assistant: "He understands Latin."

* * * *

Judge: "What possible excuse did you have for acquitting that murderer?"

Foreman of Jury: "Insanity."

Judge: "What, all twelve of you?"

* * * *

"What? Back in the city again? I thought you were a farmer."

"I made the same mistake.'

* * * *

"When I shot this," said the explorer, boastfully, pointing to a tiger skin, "it was either me or the tiger."

"Well, I suppose the tiger does make a better rug," said a listener.

* * * *

Corporal: "That new recruit used to be a clerk."

Sergeant: "How do you know?"

Corporal: "Well, every time he stands at ease he tries to put his rifle behind his ear."

* * * *

Teacher: "Johnny, give me a sentence with the word sphere."

Johnny: "I have a sphere cold."

* * * *

Tom: "I've got news, dad."

Dad: "Well, have you passed your exam.?"

Tom: "I haven't exactly passed, but I was top of those that failed."

* * * *

Mother: "Jackie, you mustn't play the piano when your father is sleeping."

Jackie: "It's all right, mother, I've got gloves on."

* * * *

Angry Customer: "I can't find words to express my feelings towards you."

Smart Assistant: "That's all right, sir. We sell dictionaries here."

GOOD ENGLISH

Customs Officer (to Chinese immigrant): "What is your name?"

Chinese: "Sneeze."

"Is that your real name?"

"No. Me translate it into velly good English."

"Well, what is your native name?"

"Ah Choo."

* * * *

Lawyer (reading out will): "And to my nephew for his kindness in calling every week to feed my darling goldfish, I leave—my darling goldfish."

* * * *

"I like that last piece you played," said Mrs. Gaswell. "Was it a composition of your own?"

"Madam," replied the musician, "I was putting a new E string on my violin."

* * * *

Visitor: "What is your name, my good man?"
Prisoner: "Convict No. 999."
Visitor: "But that is not your real name?"
Prisoner: "No, only my pen name."

* * * *

Mrs. Sykes: "Now, don't forget, Tommy, if anyone asks where your father is, he's gone away for a fortnight —not 14 days."

* * * *

THIS MONTH'S HOWLER

Dust is mud with the juice squeezed out.

* * * *

A man entered a barber's shop and demanded a hair-cut,

"But—but—" said the man in the shop.

"Don't 'but' me," said the customer. "I've just left my regular barber because he was too talkative, and I insist upon your cutting my hair without a word."

At the end of the operation the man found that his head was looking like a moth-eaten scrubbing-brush.

"What do you mean by this?" he cried, jumping out of the chair.

"It's the best I can do, sir," said the man. "You see, the barber has gone out. I'm the plumber, and I just came in to mend a leaky pipe."

* * * *

Householder (who has been watching delivery from the window): "I think, coalman, there are several large pieces of coal in your cart which have fallen out of my sacks."

Indignant Coalman: "I'll bring 'em in, mum. And there's a bit in my eye you can 'ave as well when I get it out."

* * * *

Bill: "I have a cold in my head."

Jack: "Well, you must have something up there."

* * * *

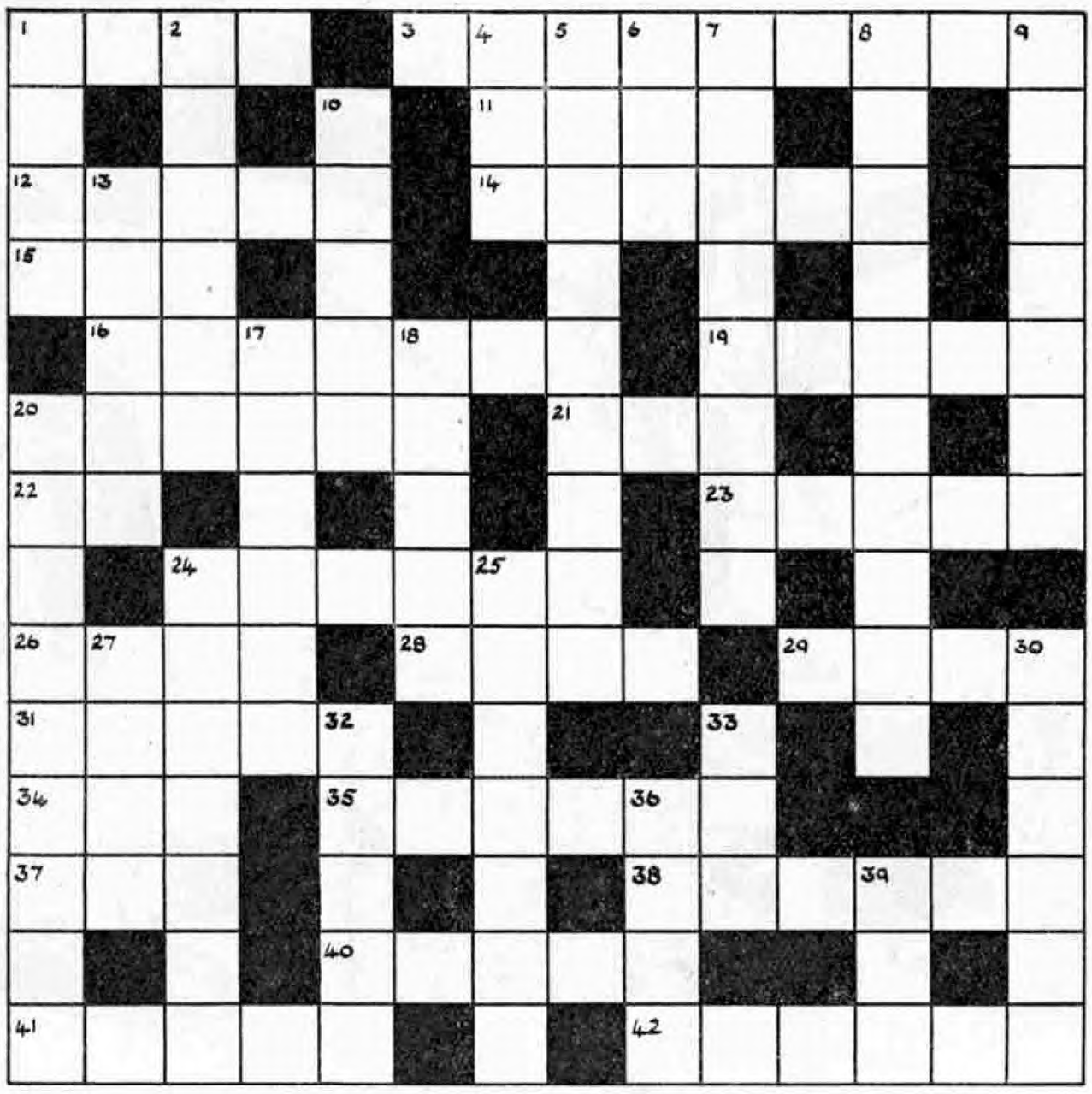
FORCE OF HABIT



A man was walking down a London street with his left hand up in a peculiar manner. An inquisitive visitor asked him the reason, and also pointed out that a man a few yards behind him was doing the same. The man turned, saw the other, and exclaimed: "Great Scott, Bill we've forgotten the ladder."

Competition Corner

AUGUST CROSSWORD PUZZLE



CLUES ACROSS

1. Large oven
3. Assembly
11. Small bird
12. The ant
14. To mourn
15. Downy covering
16. Goddess of vengeance
19. Poison
20. Behind
21. Plant
22. As regards
23. Fatigued
24. Kind of beetle
26. Genus of plants
28. Destiny
29. Large headed nail
31. Common wild flower
34. Tavern
35. Embrocation
37. Shelter
38. To stick to
40. Multitudes
41. Violent attack
42. Ships' rigging

CLUES DOWN

1. Sharp
2. Clinging shellfish
4. Small boring instrument
5. To carry
6. Border
7. To weaken
8. To make tender
9. Smartened
10. Extreme
13. Clergyman's residence
17. Interlocks
18. To extinguish
20. Small quadruped
24. Counterfeiters
25. Serious
27. A narrow street
30. Eliminate
32. Sailing vessel
33. Wicked
36. Throw
39. Largest deer

This month we give another of the popular "*M.M.*" crossword puzzles, which are intended for amusement rather than strenuous competitive effort. This month's puzzle will be found to follow the lines of those set in previous issues in that it is fair and interesting. The clues are all perfectly straightforward, and every word used can be found in Chambers' or any other standard dictionary.

Prizes of Meccano Products to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded in order of merit to the senders of the four correct solutions that are neatest or most novel in presentation. The prizes will be duplicated for the Overseas section, which is open to all readers living outside Great Britain, Ireland and the Channel Islands.

Entries should be addressed "August Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 31st August. Overseas readers' entries must arrive not later than 30th November.

August Photo Contest

Each month this summer we are offering prizes for the best photographs submitted. There are no restrictions as to subject, size, make of camera, film or paper, but each print must bear a title and the exposure must have been made by the competitor.

Entries for each month's competition will be divided into two sections, A for readers aged 16 and over, B for those under 16; and prizes of Meccano products or Photographic Materials, as chosen by the winners, to the value of 21/– and 10/6 will be awarded in each section.

In addition to its title, each print must bear on its back the competitor's name, age and address. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose.

Entries sent this month must be addressed "August Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st August. Overseas closing date 30th November.

Competition Closing Dates

HOME		
August Photo Contest...	...	31st August
August Crossword Puzzle	...	31st August
OVERSEAS		
Coronation Eye Teaser	...	31st August
May Photo Contest ...	...	31st August
June Photo Contest ...	...	30th September
June Crossword Puzzle	...	30th September
July Photo Contest ...	...	30th October
July Sketchogram Contest	...	30th October
August Photo Contest...	...	30th November
August Crossword Puzzle	...	30th November

Watch the Closing Dates:

Competitors, both Home and Overseas, are particularly requested to make a careful note of the closing dates of the competitions.

In sending entries to competitions that are divided into age groups, competitors should take particular care to mark their ages clearly on the back of the entry. It is not sufficient merely to indicate the age group, as age allowances are given to ensure equality of opportunity for the younger competitors.

COMPETITION RESULTS

HOME

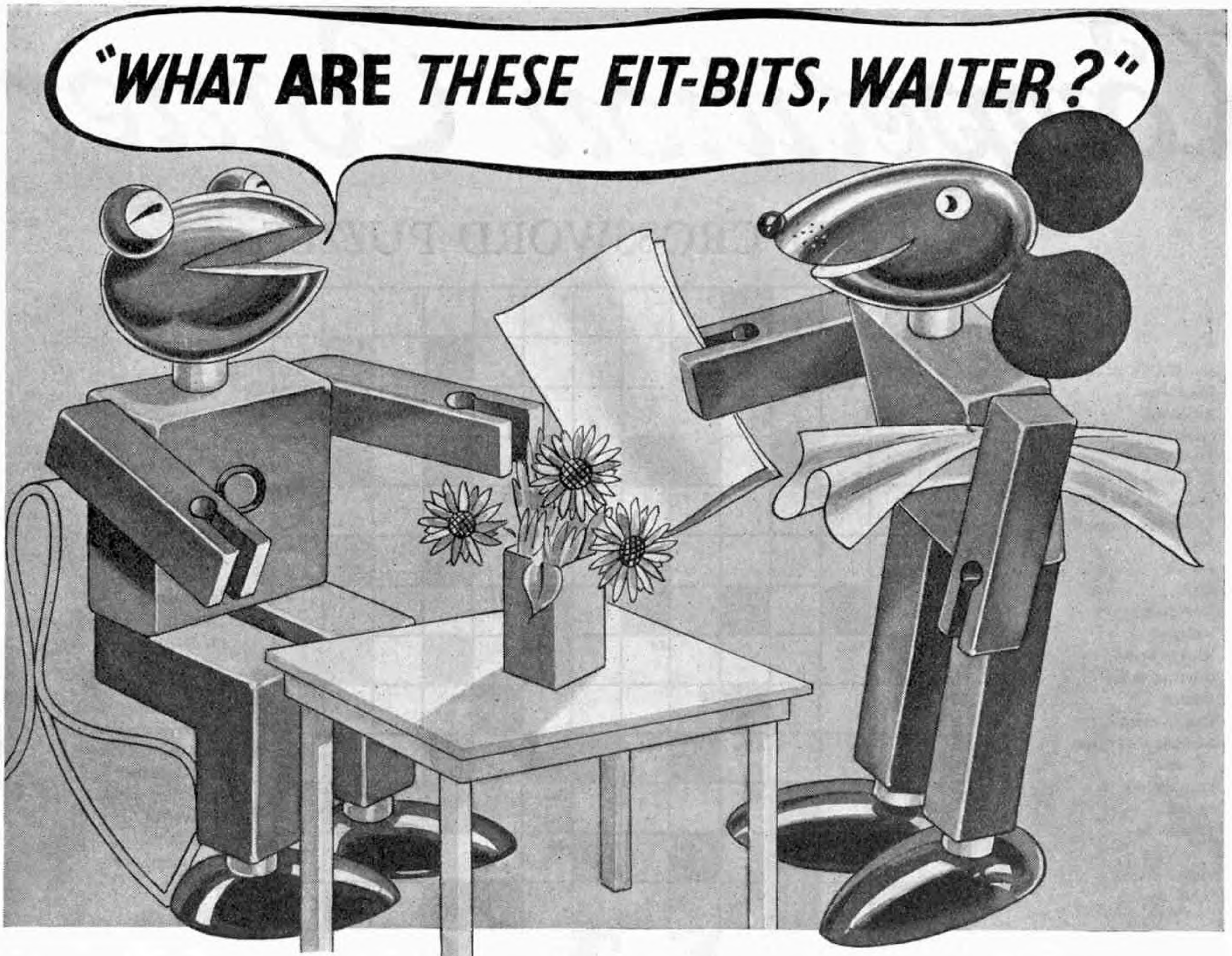
June Crossword Puzzle.—1. L. W. Chitty (London, S.W.20). 2. K. Costain (Bolton). 3. G. Argent (London, S.E.19). 4. G. Erskine (Tunbridge Wells). Consolation Prizes: O. B. Goff (Dublin); J. S. G. Brown (Glasgow).

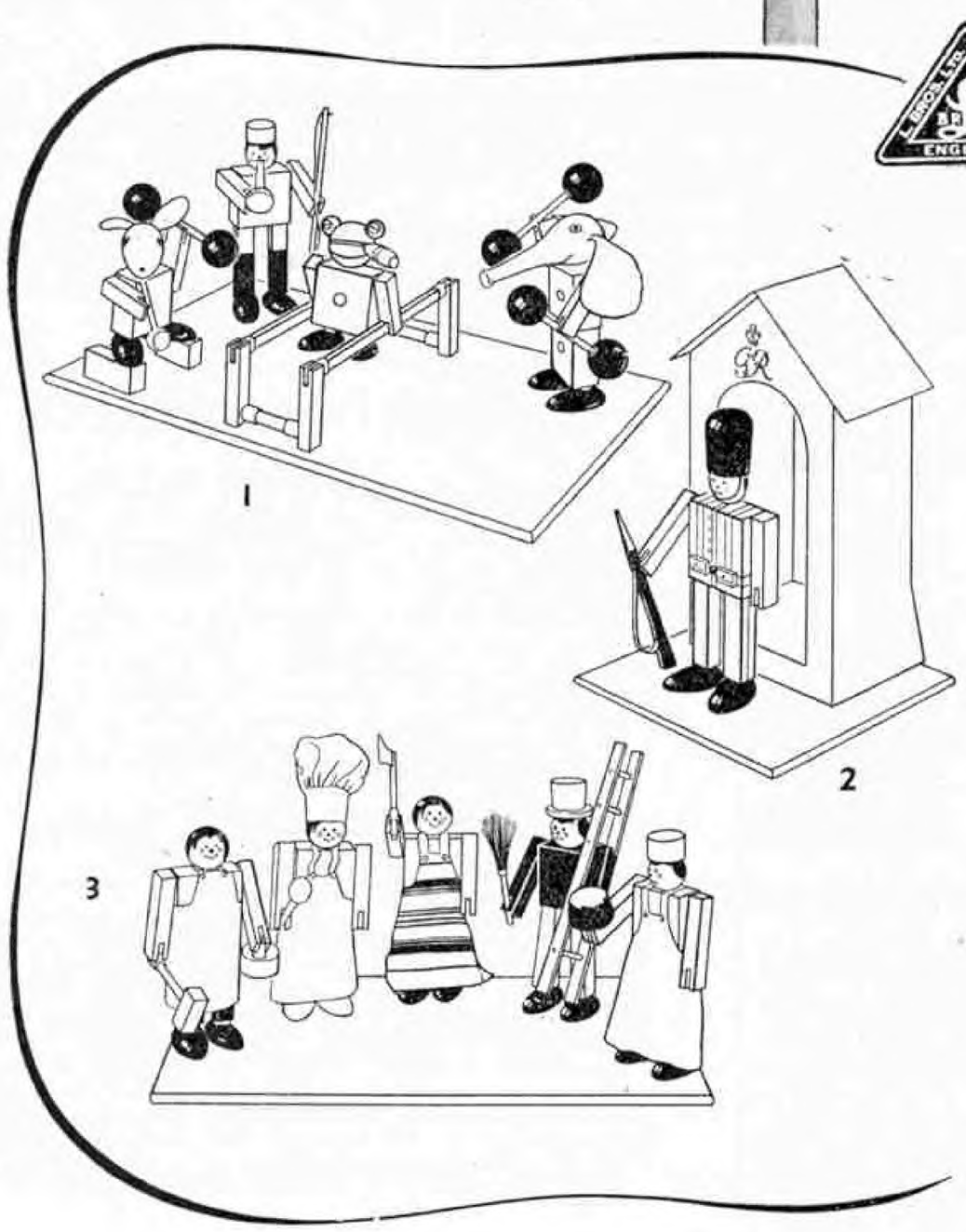
June Photo Contest.—First Prizes: Section A, R. P. Tonkin (London, E.18); Section B, J. C. Needham (Enfield). Second Prizes: Section A, H. Auger (Lincoln); Section B, P. F. Chapman (St. Leonards-on-Sea). Consolation Prizes: T. Brooks (Halifax, Yorks.); F. H. Culverhouse (Sheffield); J. L. Graves (Stone); A. A. Hind (London, N.3); P. M. Walker (Reigate).

Overseas "Car Faces" Voting Contest

The extraordinary popularity of this competition was shown by the huge entry in this as well as in the Home Section, and the order of popularity of the cars as shown by the votes of competitors was identical in the two Sections. The order was as follows: Ford; Rolls Royce; S.S.; Hillman; Triumph; Bentley; Vauxhall; Morris; Daimler; Lanchester; Morgan; Singer.

No reader succeeded in giving a completely accurate forecast of this order, and the prizes were awarded as follows: 1. J. C. P. Reader (Taumarunui, N.Z.). 2. M. Cohen (Capetown, S. Africa). 3. G. F. Emmerson (Greymouth, N.Z.). 4. T. L. Hilliard (Otahuhu, N.Z.).





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Small illustrations:

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3. Five Merry Men, 3MM ... **7'6**

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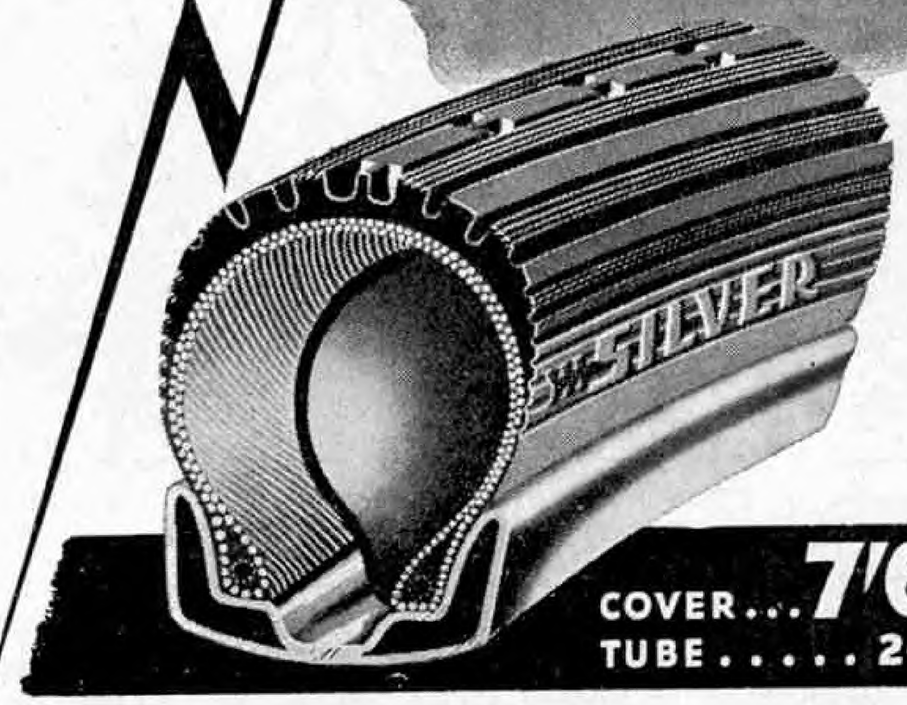
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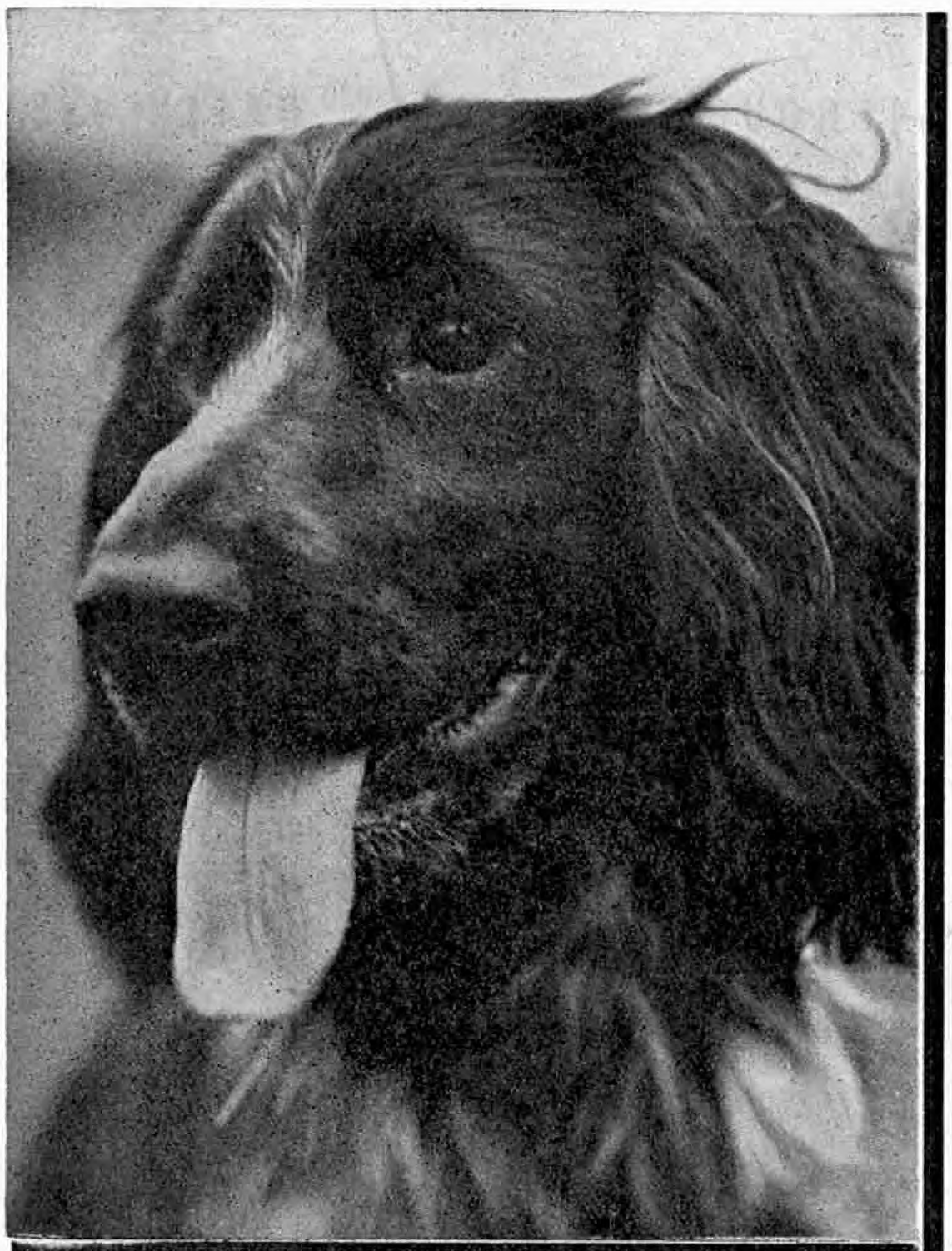
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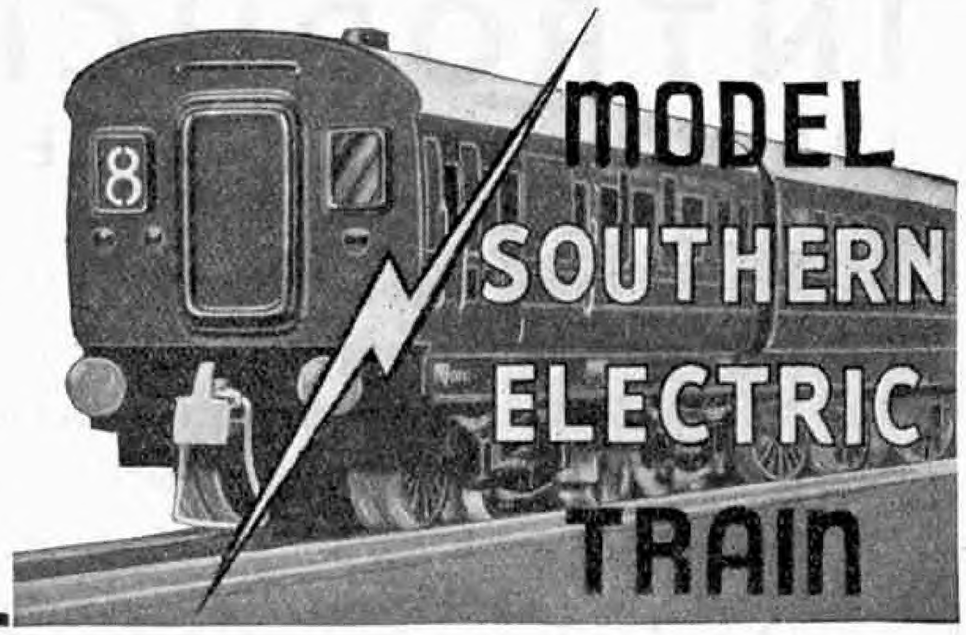
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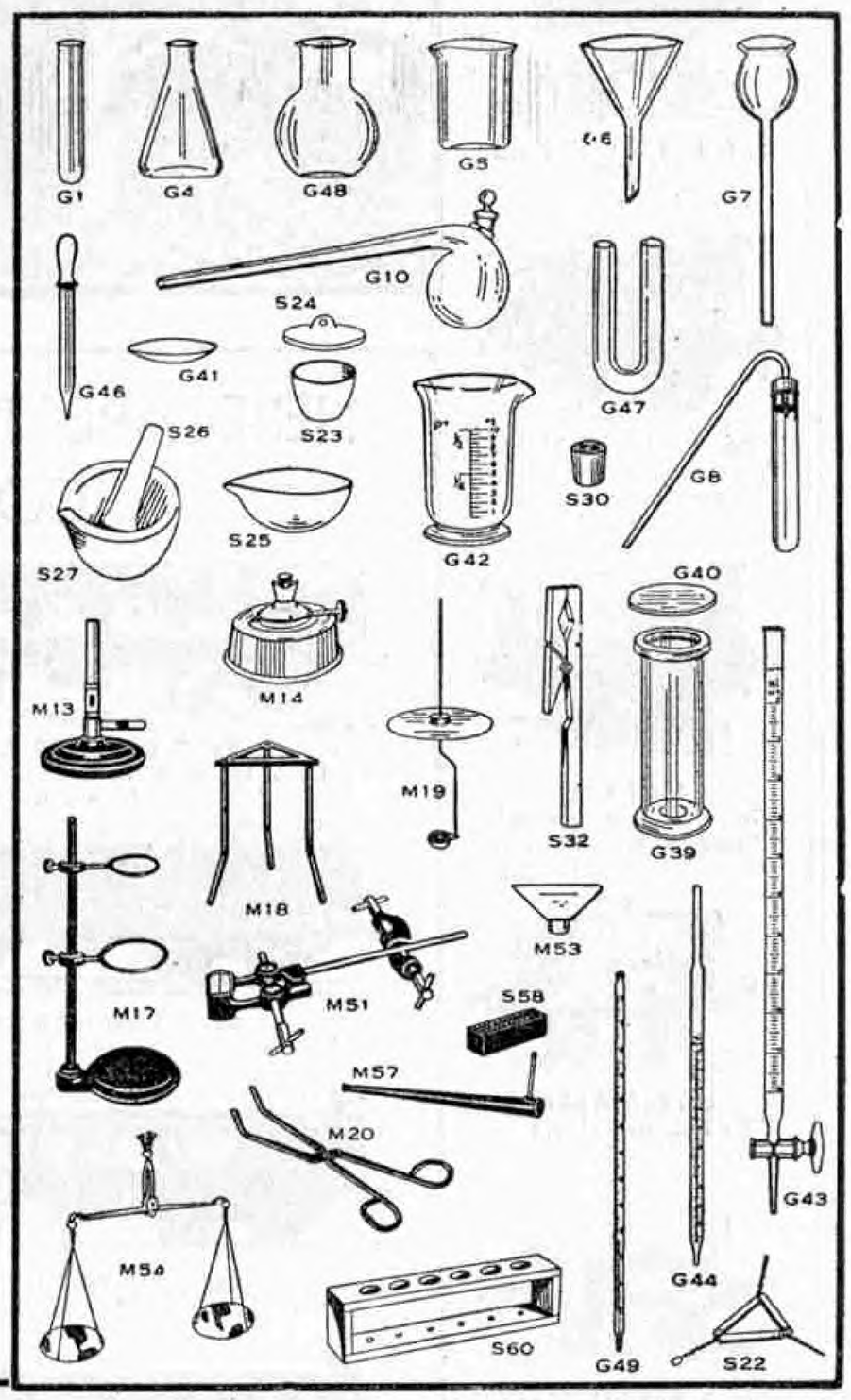
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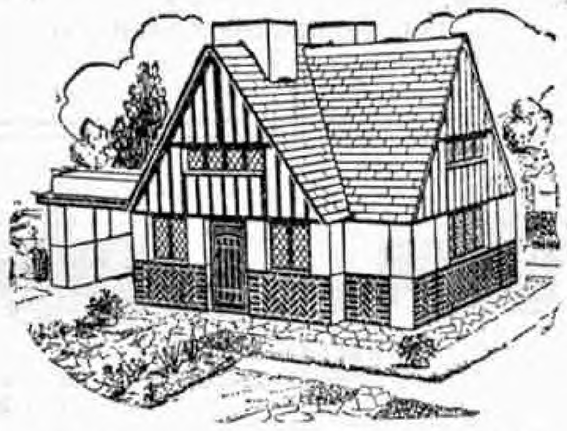


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,, 6.	**96**	**,, ...**	**21/-**

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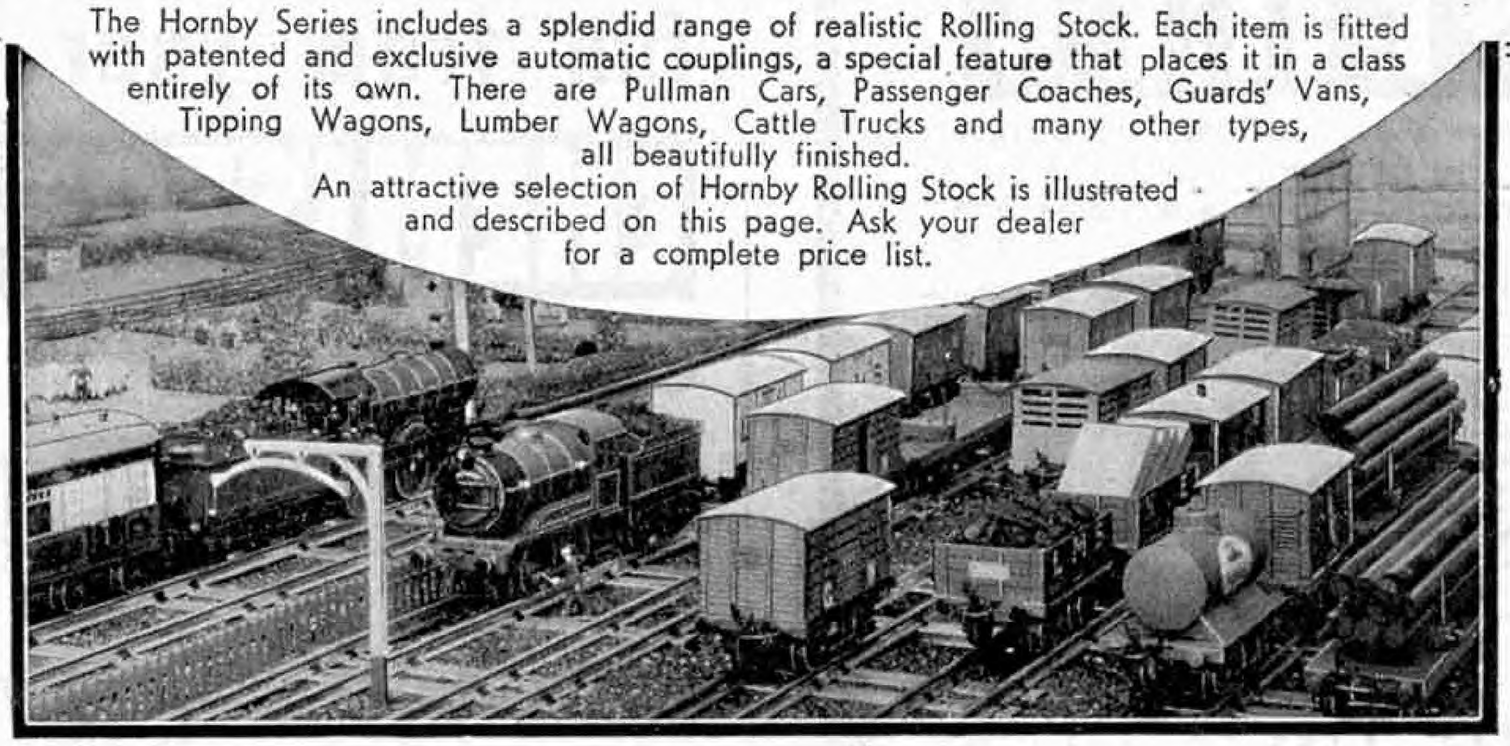
LOTT'S BRICKS LTD., WATFORD HERTS.

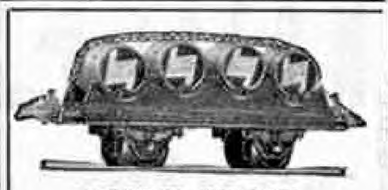
HORNBY SERIES

HORNBY ROLLING STOCK

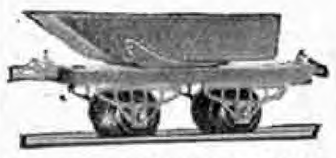
GAUGE O

The Hornby Series includes a splendid range of realistic Rolling Stock. Each item is fitted with patented and exclusive automatic couplings, a special feature that places it in a class entirely of its own. There are Pullman Cars, Passenger Coaches, Guards' Vans, Tipping Wagons, Lumber Wagons, Cattle Trucks and many other types, all beautifully finished.
An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.

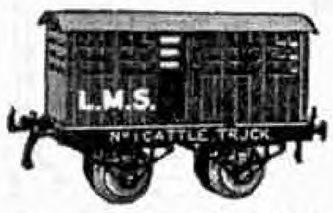




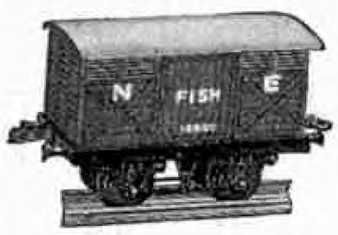
BARREL WAGON
This is an interesting model of a type of wagon used in France and other European countries.
Price **2/6**



No. 0 ROTARY TIPPING WAGON
Price **1/6**



***No. 1 CATTLE TRUCK**
Fitted with sliding doors. Very realistic design.
Price **2/9**



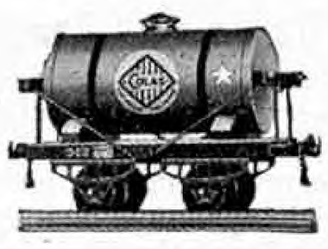
FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/9**



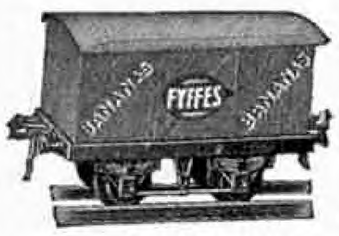
OIL TANK WAGON "ROYAL DAYLIGHT"
Price **2/-**



No. 1 PETROL TANK WAGON "ESSO"
Price **2/-**



BITUMEN TANK WAGON "COLAS"
Finished in blue.
Price **3/6**

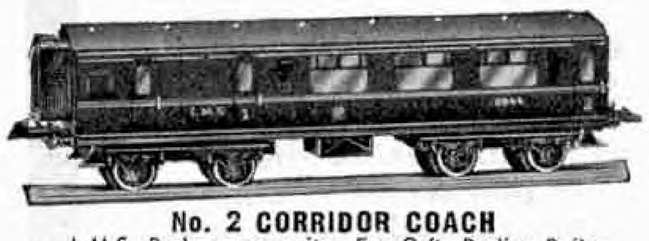


No. 1 BANANA VAN "FYFFES"
Sliding doors.
Price **2/9**

HERE ARE THE SPLENDID NEW HORNBY CORRIDOR COACHES!!



No. 2 CORRIDOR COACH
L.M.S. First-third. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
L.M.S. Brake composite. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
L.N.E.R. First-third. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
L.N.E.R. Brake composite. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
G.W. First-third. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
G.W. Brake composite. For 2 ft. Radius Rails only.
Price **7/6**



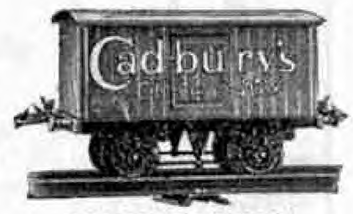
No. 2 CORRIDOR COACH
S.R. Third class. For 2 ft. Radius Rails only.
Price **7/6**



No. 2 CORRIDOR COACH
S.R. Brake composite. For 2 ft. Radius Rails only.
Price **7/6**



No. 1 ROTARY TIPPING WAGON
Finished in orange.
Price **2/6**



CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof.
Price **2/9**



***HOPPER WAGON**
Mechanically unloaded. Finished in green.
Price **3/6**



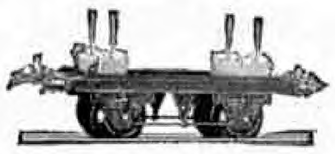
MILK TANK WAGON "NESTLE'S MILK"
Price **4/6**



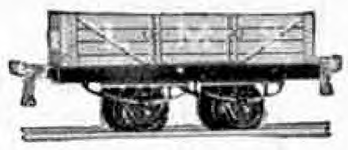
"PORTLAND CEMENT" WAGON
The door at the top opens. Finished in bright red.
Price **2/6**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only.
Price **3/9**

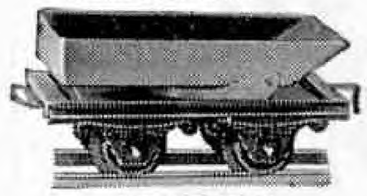
No. 2 HIGH CAPACITY WAGON
Finished in correct colours of G.W.R. and L.M.S. "Loco Coal" Wagons, or L.N.E.R. "Brick" Wagon. For 2-ft. radius rails only.
Price **3/9**



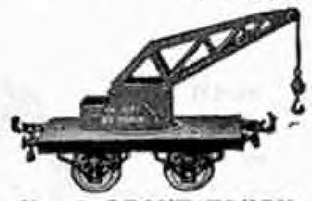
No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport.
Price **1/6**



***No. 0 WAGON**
Price **1/6**



MO ROTARY TIPPING WAGON
Price **1/-**



No. 1 CRANE TRUCK
Finished in brown and blue.
Price **2/11**



COAL WAGON
Fitted with embossed representation of coal.
Price **2/3**

*In L.M.S., N.E., G.W. or S.R. Lettering.

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

Hornby Series **HORNBY ACCESSORIES** Gauge O

There is a splendid variety of Railway Accessories in the Hornby Series, each one built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown below. Ask your dealer to show you the full range.



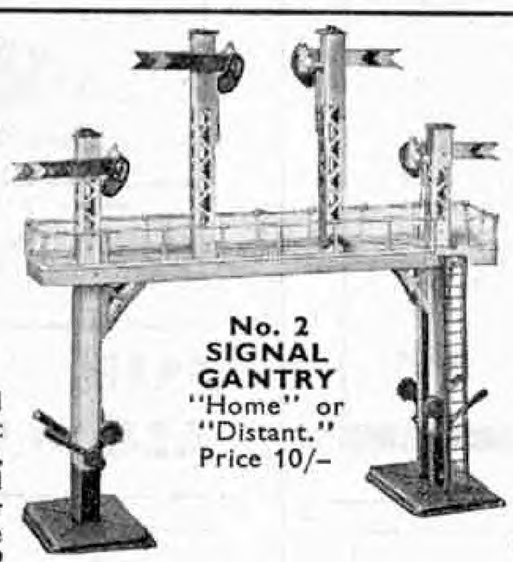
No. 2 JUNCTION SIGNAL "Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price 4/9



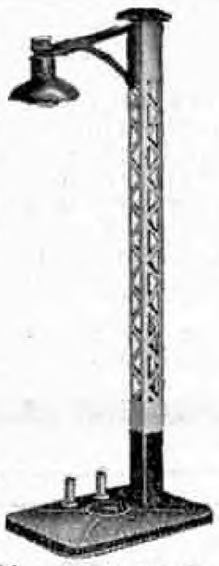
TELEGRAPH POLE Price per pair 3/6



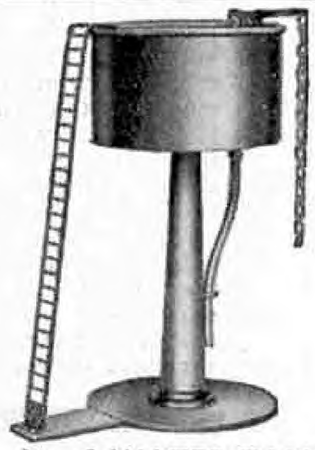
No. 2 SIGNAL CABIN Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price 3/9



No. 2 SIGNAL GANTRY "Home" or "Distant." Price 10/-



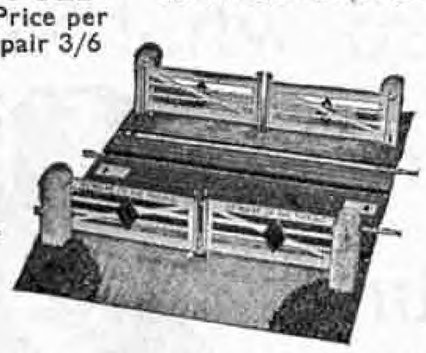
No. 1E LAMP STANDARD (Single) Price 2/11



No. 2 WATER TANK Fitted with flexible tube and valve lever. Stands 8½ in. high. Price 5/9

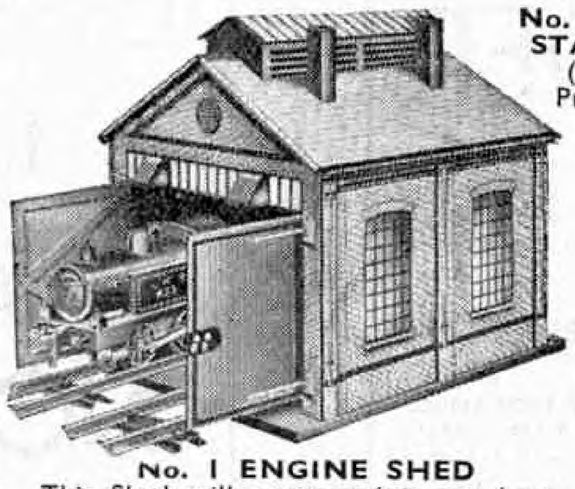


No. 2 SIGNAL "Home" or "Distant." Price 2/-



No. 2 LEVEL CROSSING Measures 13½ x 10½ in., with two tracks of gauge O rails in position, as illustrated. Price 5/6

No. 1 LEVEL CROSSING Suitable for single track only. Price 2/11



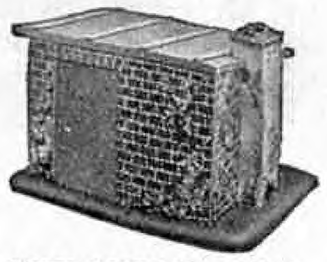
No. 1 ENGINE SHED This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price 15/-



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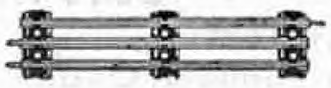
PLATELAYER'S HUT Price 1/-

HORNBY RAILS, POINTS and CROSSINGS

GAUGE 0, 1¼". HORNBY SERIES.

Hornby Rails, Points and Crossings are built for hard wear and for smooth running.

There is practically no limit to the number of rail formations that can be built with them. Their adaptability is well shown in the booklets "How to Plan your Hornby Railway" and "Hornby Layouts–100 Suggestions," both of which may be obtained from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d.



EB1



ECR



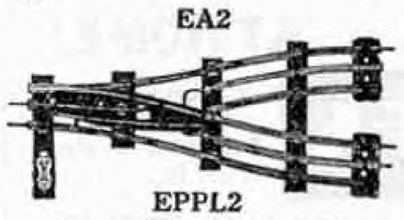
EA2½



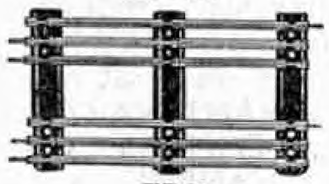
EB½



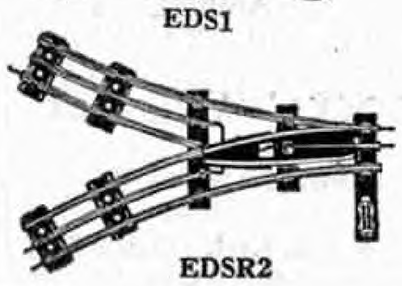
EA2



EPPL2



EDS1



EDSR2

GAUGE 0, 1¼". HORNBY SERIES.

Hornby Rails, Points and Crossings are built for hard wear and for smooth running.

There is practically no limit to the number of rail formations that can be built with them. Their adaptability is well shown in the booklets "How to Plan your Hornby Railway" and "Hornby Layouts–100 Suggestions," both of which may be obtained from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d.

A SELECTION OF RAILS, POINTS AND CROSSINGS FOR ELECTRIC TRAINS

EB1 Straight rails ... ... per doz. 5/-
EB½ „ half rails ... „ „ 4/6
EA2½ Curved quarter rails (2 ft. radius) ... ... „ „ 4/-
EA2 Curved rails (2 ft. radius) „ „ 5/-
EPPR2 Parallel points, right-hand ... ... } per pair 7/-
EPPL2 Parallel points, left-hand ... ... }
These points can be used with either 1 ft. or 2 ft. radius track.
EPR2 Right-hand points (2 ft. radius) ... ... } per pair 7/6
EPL2 Left-hand points (2 ft. radius) ... ... }
EPR1 Right-hand points (1 ft. radius) ... ... } per pair 5/9
EPL1 Left-hand points (1 ft. radius) ... ... }

EDS1 Straight rails, double track ... ... ½ doz. 8/6
EDSR2 Double symmetrical points, right-hand (2 ft. radius) ... ... } per pair 7/-
EDSL2 Double symmetrical points, left-hand (2 ft. radius) ... ... }
EDSR1 Double symmetrical points, right-hand (1 ft. radius) ... ... } per pair 6/-
EDSL1 Double symmetrical points, left-hand (2 ft. radius) ... ... }

FOR CLOCKWORK TRAINS

B1 Straight rails ... ... per doz. 3/6
A1 Curved rails (1 ft. radius) „ „ 3/6
PR1 Right-hand points (1 ft. radius) ... ... } per pair 3/-
PL1 Left-hand points (1 ft. radius) ... ... }
PR2 Right-hand points (2 ft. radius) ... ... } per pair 3/-
PL2 Left-hand points (2 ft. radius) ... ... }

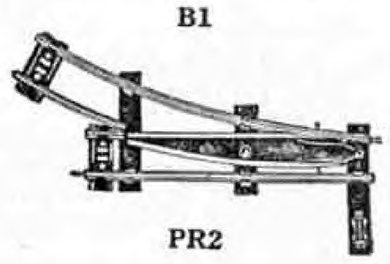
CA2 Acute-angle crossings (for 2 ft. radius track) each 1/6
PPR2 Parallel points, right-hand ... ... } per pair 3/6
PPL2 Parallel points, left-hand ... ... }
The above can be used for either 1 ft. or 2 ft. radius track.
DC2 Curved rails, double track, 2 ft. radius only ... ½ doz. 6/-

Ask your dealer for an illustrated price list.

MECCANO LIMITED, Binns Road, Liverpool 13



B1



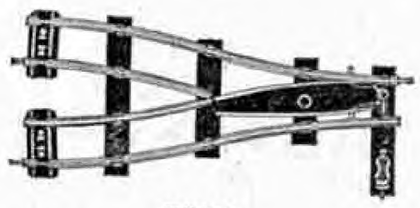
PR2



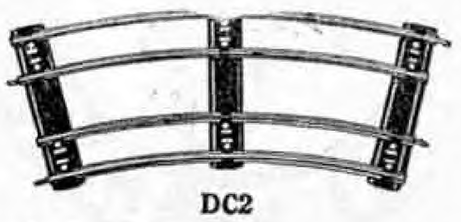
A2



CA2



PPR2



DC2



NEW MECCANO PARTS FOR OLD!

Good News for Meccano Boys

Every Meccano boy should know of the wonderful Meccano Part Exchange Scheme, in order to take the fullest advantage of it.

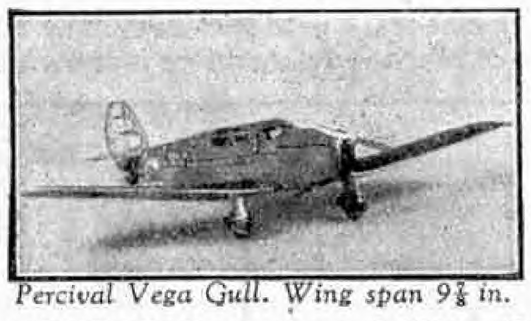
We undertake to exchange any damaged Meccano parts for similar new parts at half the current list price, no matter how old or how much damaged the parts are. Just send them to us, addressed to the Service Department, Meccano Limited, Binns Road, Liverpool 13, together with a remittance covering half the cost of the new parts. The remittance should include postage on the new parts and will be exactly the same as that you pay on the parcel of old parts you send us.

It is very important that you enclose your own name and address written in plain characters.

If you prefer to do so, you can effect the exchange through your dealer.

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Percival Vega Gull. Wing span 9⅜ in.

AEROMINOR No. 1. Any one of the following types can be made from this kit—"Hart," "Hind," "Demon," "Audax" or "Osprey." **Price 3/-.** (Postage abroad 1/- extra.)

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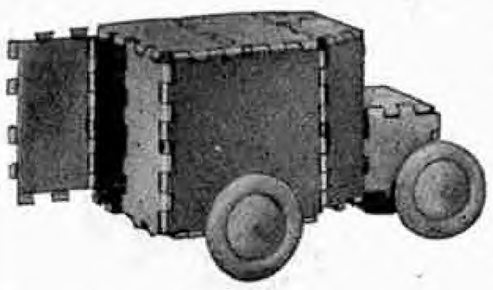
AEROMINOR No. 3. Either Hawker "Fury" or "Nimrod." **Price 2/6.** (Postage abroad 1/- extra.)

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This splendid Outfit contains a varied selection of parts, including a set of four road wheels for constructing miniature wheel toys. The Instruction Manual included shows a total of 56 fine models. Price **4/11**

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The parts in this fine Outfit make possible the construction of six groups of miniature model furniture and other wonderful models. Full instructions for building the complete range of 74 models are given. Price **7/9**

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MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

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Dinky Toys
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Kemex Chemical Outfits
Elektron Electrical Outfits

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Meccano Ltd. - Binns Road - Liverpool 13



Here is a new and interesting booklet produced in answer to the popular demand of Hornby Railway enthusiasts. It contains a wide selection of attractive rail formations, varying from quite simple layouts to more ambitious designs with double track. The best possible uses of Hornby Rails, Points and Crossings are clearly demonstrated.

The booklet is obtainable (Price 3d.) from any Meccano dealer, or (Price 4d.) post free, direct from

MECCANO LIMITED
Binns Road, Liverpool 13

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SHIPSERIES LEAGUE

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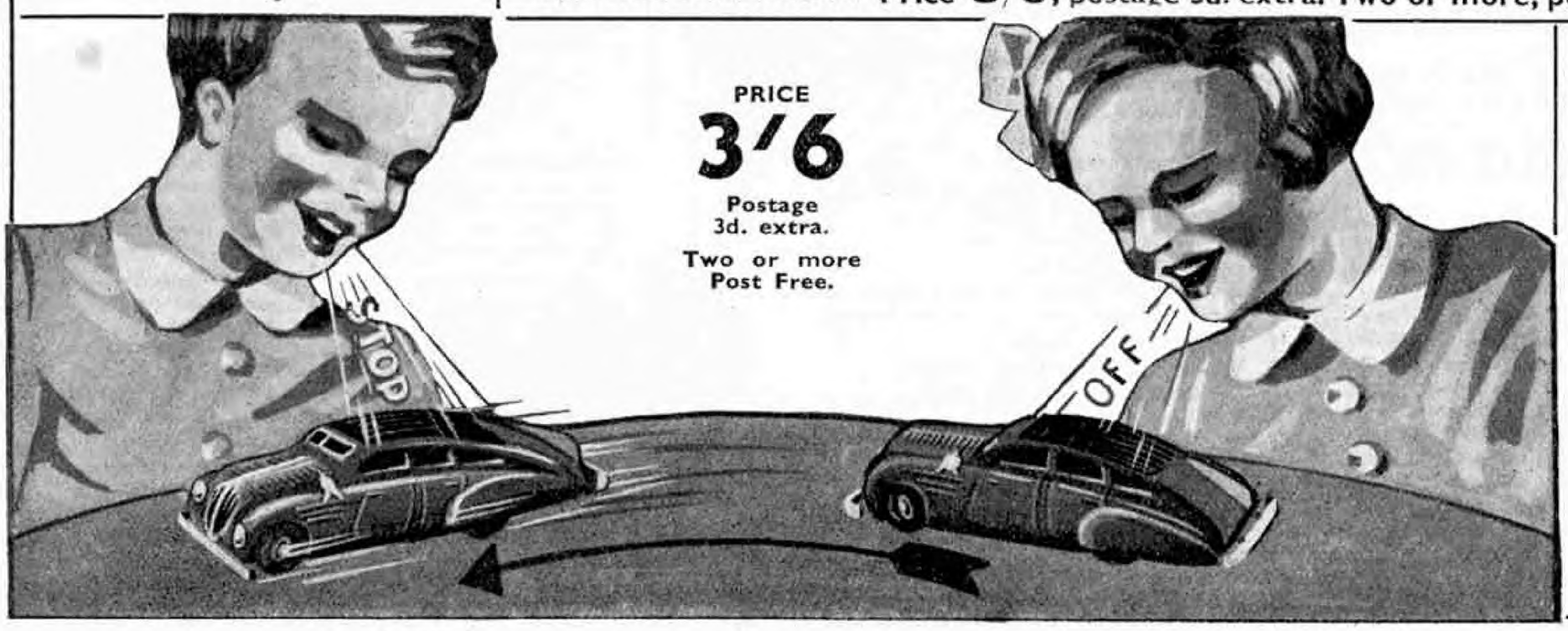
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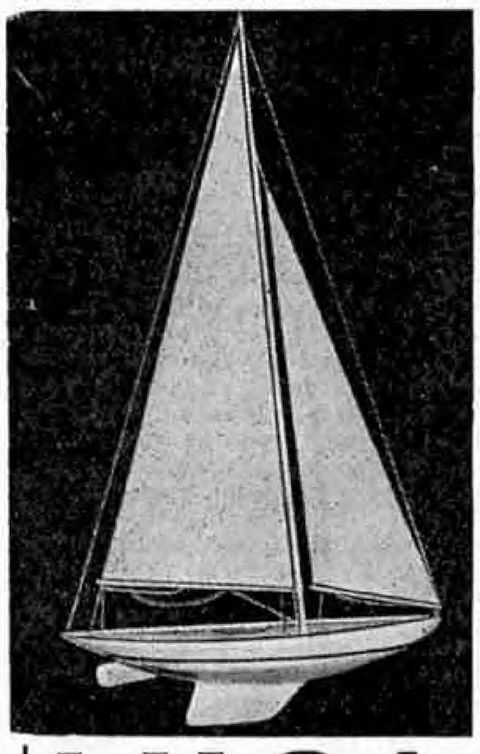
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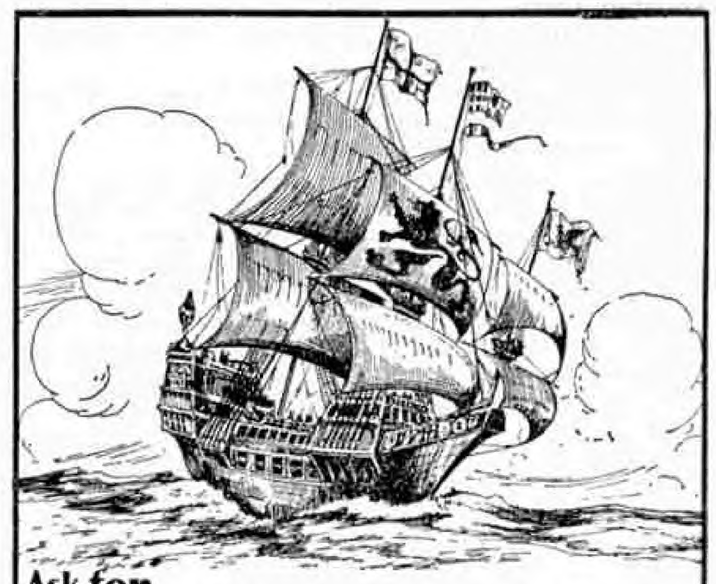
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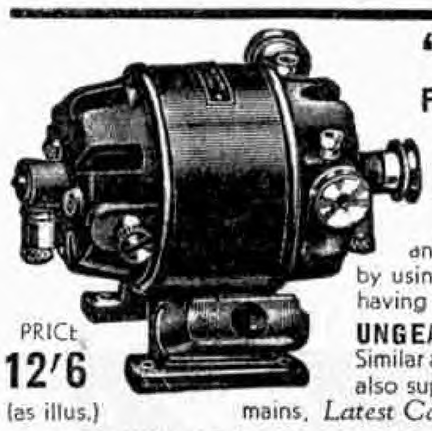
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READERS' SALES

Readers should note that all advertisements of Hornby Trains and other Meccano products included in this column relate to items no longer featured in the catalogue. Advertisements of current products cannot be accepted for this column.

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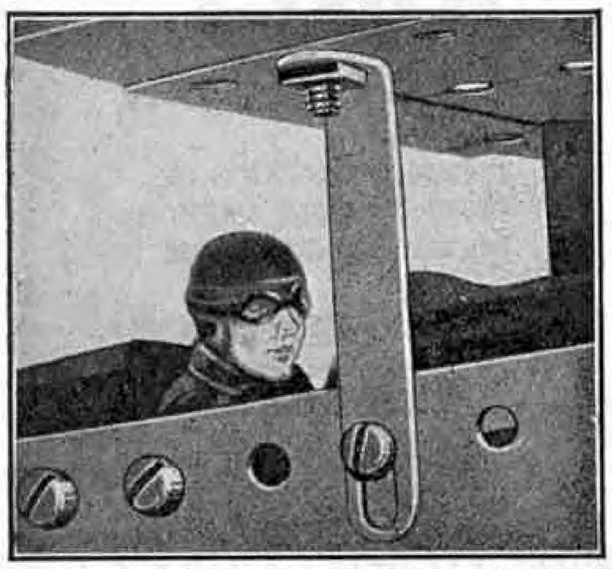
Sale. Meccano Magazines, 1932—April 1937. Excellent condition, 10/-. Graham, Cheddon, Taunton.

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Prices:

P99	Aeroplane Pilot	each	4d.
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EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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UNITED STATES: Meccano Co. of America Inc., New Haven, Conn., Meccano Co. of America Inc., 200, Fifth Av., New York.
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NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1.
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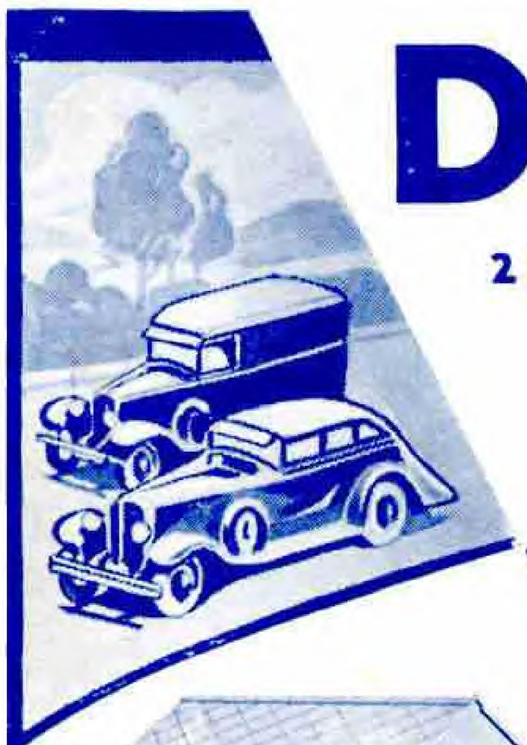
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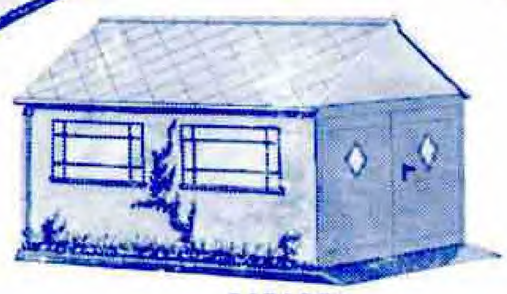


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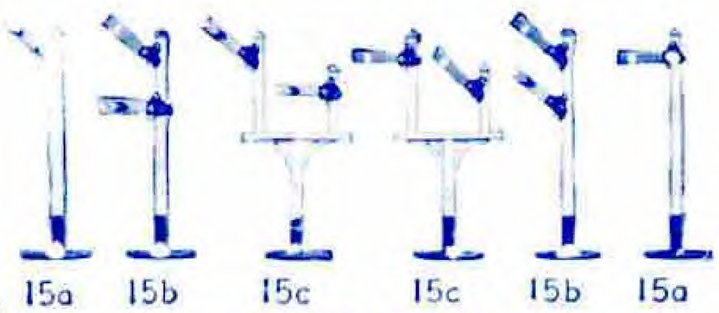
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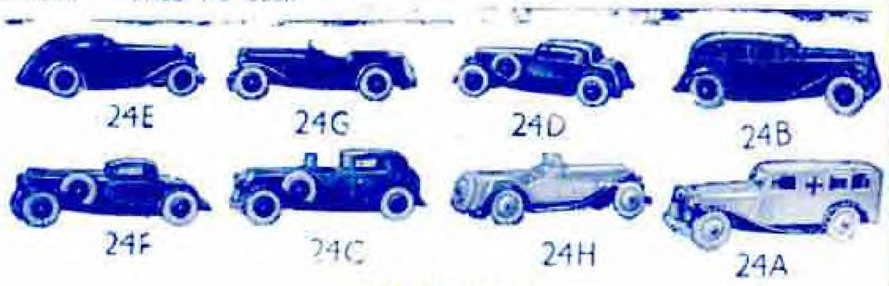
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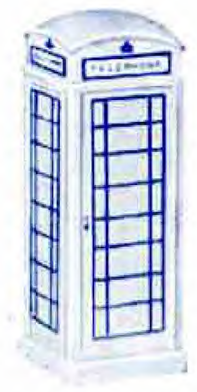
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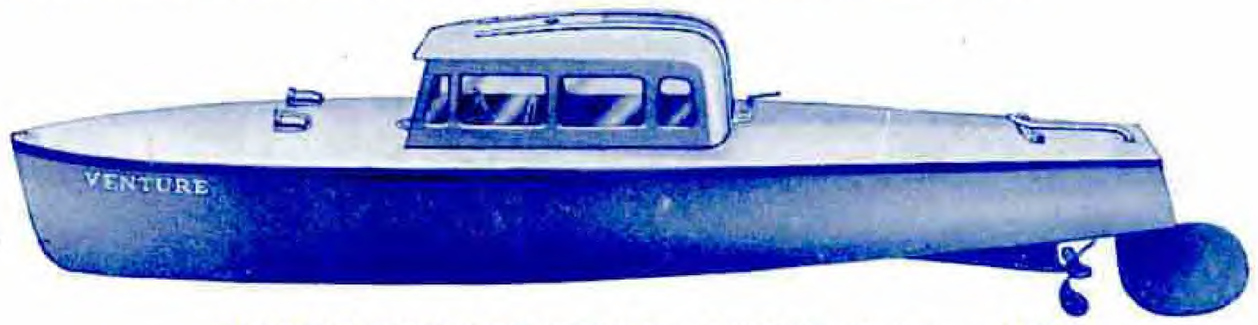
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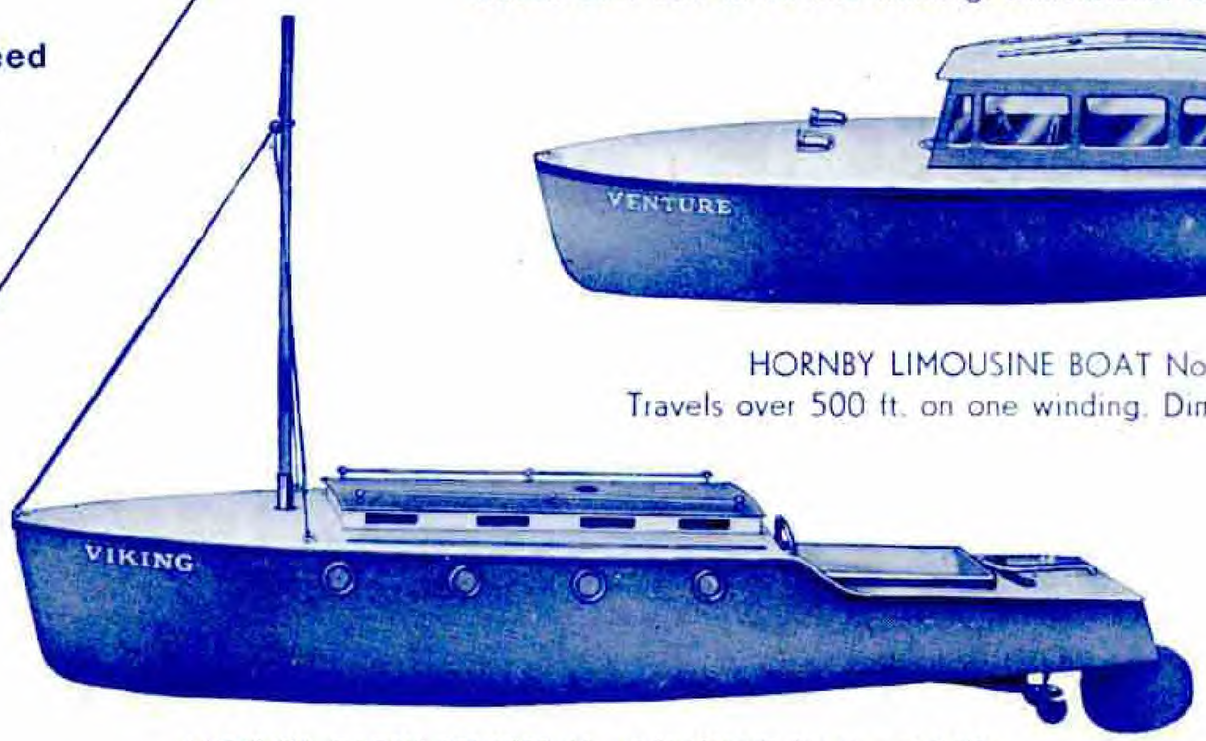
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